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The Bedaux Principle of Human Power Measurement

Origin, Definition and Scope—the B, or Unit of Measurement—Application to Compensation of Labor—Isolation from Methods, Equipment and Piece Rates—Simplicity of Records

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THE industrial world is well acquainted with several management, production, or efficiency systems that have as their aim the scientific determination of the most economical methods and use of equipment, the production that may be expected from labor, and the remuneration that should be accorded for that production. It has not become acquainted to any great extent with the Bedaux principle of human power measurement and its application in industrial plants, which it is the purpose of this article to explain.

The Bedaux system is being practiced by the Chas. E. Bedaux Co., engineers, of Cleveland, Ohio. Mr. Bedaux originated the principle and developed the system. So far as may be said of any pioneer work, it has passed the strictly experimental stage. It is now being used in the United States in some of the plants whose names and products are known to everyone. The system is characterized by the fact that it deals only with the measurement of human power, not entering the field of method and equipment. What part it plays in management will be shown.

As defined by its originator, the Bedaux principle of human power measurement is a rule of action around which a system has been built whereby there can be expressed in one common unit the work done by every human being, whether laborer or supervisor, in relation to the work that should be done. Its purpose is to provide a common denominator to which productive activity in all industries can be reduced.

Mr. Bedaux's extension of the definition states that the system permits just reward and promotion, enables accurate determination of the relation of requirement to capacity and makes possible the comparison of productive against waste effort, with the constant and exact knowledge of what should be correct in all cases.

From these statements the evident hypothesis is that the principle is definitely intended to possess a scope that will permit of its application to any productive process of any magnitude. The reader must decide whether or not the hypothesis is upheld.

The principle and system exist as the result of Mr. Bedaux's attempts to supply a substitute for the usual time-study methods which he became convinced were possessed of inherent weaknesses, in that they lacked a standard of measurement for labor, considered only the actual time to perform an operation, and did not take account of the nature of the strain on the human body. This conclusion was formed during the first several years that Mr. Bedaux spent in America, where he had come from France. He worked at many jobs, some among them bringing him into contact with time-study methods, affording the knowledge of tremendous waste in industry, and proving the existence of the field for the industrialist, or industrial engineer. He eventually engaged in time-study and efficiency work, returning for a time to France to practice.

His experience as a whole led him to believe that no matter how carefully a time-study is made, there is almost certain to be an inequality of values—some will have soft jobs, some will have better machines, some will fail because of the fault of management. These observations led to the belief that man should be considered as a force, renewed by rest, food and thought; that the force is spent in certain elementary performances, lifting, pulling, pushing, pressing; and that the nature of a movement and the frequency of its repetition determine the amount by which the force is drawn upon. The result of these beliefs was an attempt to determine the elementary motions employed by man in working, and the rest periods related to them, so that the values ascertained could be used as a basis in all time-study work.

To concretely express his conclusions, reached in this manner, and strengthened by experiment, Mr. Bedaux (in 1911) formulated a law:

> *For a muscular effort of a given power the ratio of strain is directly proportional to the rapidity of motion and completion of the cycle.*

and a corollary:

> *Rapidity of motion is inversely proportional to weight handled, pressure applied and length of cycle.*

For example, to illustrate the law, wrapping a box of safety matches in light-weight paper would require only slight muscular effort and the motion and the completion of the cycle would be of great rapidity. The ratio of strain would be great. Wrapping a two-foot cube box weighing forty pounds in heavy tarred paper would require great muscular effort and the motion and the completion of the cycle would be of low rapidity. The strain would be relatively slight. The corollary may be applied to the same example.

The first law and its corollary were later supplemented by a second law:

> *For a muscular effort of a given power the duration of work and rest periods is inversely proportional to the rapidity of motion.*

Reverting to the example of the wrapping of the two boxes, the second law means that since the rapidity of

motion in wrapping the matches is great, the work and rest periods should be short, while they should be long for the operation of wrapping the large heavy box.

The application of these laws to time-study was of course the embodiment of the consideration of strain. The results seemed to the originator of the laws to reduce to such an extent the inequalities in values that he began to standardize his data by building up a curve showing the rest or relaxation times that should be considered as necessary to offset working times, the whole based on length of cycle. This curve, begun in 1911 and finished in 1916, is the key part of the present system. It is called the relaxation curve and its limits for relaxation time in proportion to working time are 15 per cent and 210 per cent.

In practical application the time-studies are quite different from those made in usual time-study practice, both in nature and purpose. They are conducted by practical workmen employed in the departments studied in order to facilitate understanding on the part of all employees of the important part strain plays in the determination of job values. Moreover the time studies are used merely as a check so far as productive motions are concerned. They do, however, assume considerable importance in the analysis of all that is not strictly productive motion, as they are used in verifying the established strain ratios. It is considered that the form of time study generally practiced, while it shows inequalities of time in repeated fractions of operations, does not analyze the causes of the inequalities, and therefore tends toward erroneous conclusions.

In applying the system it was found that sequence of motion had a strong bearing upon strain. For example, if a sequence is made up of thirty motions,

DEPT. SECTION QUARTER, 19

Week Ending	OPERATORS			HOURS			BEDAUX					OPER	ALLOWED Bs		
	Prod.	Non-Prod.	Below Stand.	Product.	Non-Prod.	Total	Productive on Stand.	Productive at 60	Set up	Scrap	Total	B-Hr.	To Equal Standard	Idle Time	Break-down
4-11-21	33	11	11	1561.0	540.0	2101.0	95040			464	45524	69.0	6976	3095	190
4-18-21	34	12	9	1637.0	554.0	2191.0	105332			343	105675	72.0	5972	3455	730
4-25-21	34	11	9	1035.0	367.0	1402.0	70567			442	71009	72.0	4626	1435	175
5-2-21	34	12	4	1593.0	576.0	2169.0	116687			449	117136	73.0	2508	340	490
5-9-21	27	12	3	1304.0	576.0	1880.0	97868			690	98558	80.7	2317	635	
5-16-21	29	12	6	1407.8	557.9	1960.7	103030			691	103721	73.9	5306		
5-23-21	31	14	7	1562.7	645.1	2207.8	109578			960	110538	73.9	6084		75
5-30-21	33	15	7	1634.4	706.7	2341.1	118157			696	118853	74.5	6549		
6-6-21	34	15	4	1321.4	593.1	1914.5	95504			934	96438	76.5	3764		75
6-13-21	34	15	5	1553.2	693.2	2246.5	110564			3070	113634	77.0	3988		
6-20-21	30	13	2	969.6	451.3	1420.9	78801			971	79772	86.2	1430		
6-27-21	31	14	2	1427.5	648.4	2075.9	122687			783	123470	85.9	1244		
7-4-21	30	13	1	1573.9	629.0	2202.9	131050			1690	132740	83.3	380		
Quarterly Fig.															

Week Ending	DIVISION OF PRODUCTIVE PAYROLL						COST PER B					
	Total	Prod. at Std.	Prod. at 60	Set up	Scrap	Allowance	Product.	Stand.	Prod. at 60	Set up	Scrap	Allow
4-11-21	$790.67					$129.00	$0.00832	$0.00696				$0.00136
4-18-21	870.47					116.60	0.00826	0.00716				0.001105
4-25-21	571.01					57.80	0.00809	0.00727				0.000892
5-2-21	903.08					41.60	0.00774	0.00739				0.000367
5-9-21	786.33					58.30	0.00803	0.00744				0.000596
5-16-21	839.32					77.20	0.00815	0.00741				0.000749
5-23-21	879.77					79.00	0.00803	0.00731				0.000721
5-30-21	925.76					64.10	0.00784	0.00725				0.000584
6-6-21	748.16					59.60	0.00783	0.00721				0.000624
6-13-21	841.38					76.65	0.00760	0.00691				0.000693
6-20-21	557.94					31.80	0.00708	0.00668				0.000409
6-27-21	785.67					7.85	0.00640	0.00634				0.00006
7-4-21	846.99					2.45	0.00645	0.00643				0.00002
Quarterly Fig.												

FIG. 1—BEDAUX

The heading *Operators* covers the total number of operators, which equals the productive plus the nonproductive. The column *Below Standard* shows the number of productive operators below standard. The heading *Hours* covers the productive and nonproductive hours worked by the department and their total. The heading *Bedaux* covers in the column *Productive on Standard* the number of Bs produced by the productive operators on work on which B values have been set. The figures are obtained from the work records. The column *Productive at 60* is for record on operations on which no B values have been set. The column *Set-up* is used to record Bs on set-up work on which B values have been set. The column *Total* equals the sum of the other columns (in the example shown "Productive on Standard" plus "Scrap"). It represents the total energy expended. The *Operator B-hr.* is equal to the "Productive on Standard" divided by the number of "strictly productive hours." The "strictly productive hours" equals "Productive on Standard" in Bs, divided by "Productive Hours" minus the quantity *Total* (under "allowed Bs") minus Bs allowed to equal standard, divided by 60. For example, to obtain the *Operator B-hr.* in the first line, $\frac{95{,}060}{1{,}561 - \frac{18{,}511 - 6{,}976}{60}} = 69$ (approx.) The value 69 is

fifteen of them identical, the strain will be greater if the fifteen identical ones are together than if they alternate with the others. As a consequence there was built up a table of added allowances on the sequence of motion. In the same way another table of allowances was made to take care of the effect upon strain of the position of the body. As an example, strain is greater when performing an operation with the elbow at the height of the shoulder rather than at the height of the waist.

Once having the capacity to determine the exact nature of the strain, and therefore the exact allowance for relaxation required, the industrialist is in position to arrive at a figure of effort and relaxation combined which becomes comparable in all cases. It is necessary however to have a unit of measurement, or in other words to make uniform application. The Bedaux system reduces everything to what would ordinarily be called points, but which the system terms Bs.

A B is a fraction of a minute of work plus a fraction of a minute of rest, always aggregating unity, but varying in proportions according to the nature of strain.

Continuing the example of the simple operations of wrapping the two boxes: If because of the nature of the operation on the wrapping of the small box the allowance for rest must be 160 per cent, the base cycle of performance being one second, the total becomes one second plus 1.6 sec., which equals 2.6 sec., or B0.0433 (2.6 ÷ 60). And if because of the nature of the operation on the wrapping of the large box, the allowance for relaxation must be 30 per cent, the base cycle of performance being four minutes, the total will be four minutes plus 1.2 min., which equals 5.2 min. or B5.2. The two oper-

2446-10-11-21-1500

ALLOWED Bs			Dept. B-Hr.	NON-PRODUCTIVE Bs						
Reaper	Misc.	Total		Supervision	Handling	Clerkship	Maintenance	Shutdown	Total	Week Ending
1150	7100	18511	61.0	2880	29505				32385	4-11-21
1215	4880	16252	64.0	2880	30345				33225	4-18-21
734	965	7955	68.0	1840	20180			4160	26180	4-25-21
1627	370	5635	73.0	2880	31650				34530	5-2-21
1593	3304	7849	75.0	2880	31665				34545	5-9-21
1115	4024	10444	70.1	2880	30594				33474	5-16-21
1726	3928	10713	70.1	2880	35826				38706	5-23-21
1992	987	9528	72.3	2880	39522				42402	5-30-21
1731	2588	8258	72.3	2358	32164			1044	35586	6-6-21
1900	5200	11088	71.1	2880	38718				41598	6-13-21
1349	1992	4771	81.2	2088	24198			792	27078	6-20-21
		1244	85.9	2880	36024				38904	6-27-21
		380	83.3	2880	34860				37740	7-4-21
										Quarterly Fig.

Non-Prod. Payroll	COST PER B				RATIO OF			Super.	Base of Super. Premium	Premium	
Total	Non-Prod.	Std. N-Prod.	Total	Std. Total	Allow to Std.	N.-Prod. to Prod	Std. Tot. to Tot.	B-Hr.		Bs	Week Ending
$233.47	$0.00245	$0.0020	$0.01077	$0.01773	0.195	0.29		100.4			4-11-21
254.07	0.00241	0.0020	0.01067	0.00916	0.154	0.29		55.0			4-18-21
186.52	0.00264	0.0020	0.01073	0.00927	0.113	0.33		58.8			4-25-21
231.33	0.00198	0.0020	0.00972	0.00939	0.0483	0.256		70.6			5-2-21
231.57	0.00236	0.0020	0.01039	0.00944	0.0802	0.294		68.2			5-9-21
224.51	0.00217	0.0020	0.01032	0.00941	0.101	0.266		63.8			5-16-21
257.25	0.00230	0.0020	0.01033	0.00931	0.0987	0.286		63.2			5-23-21
269.80	0.00224	0.0020	0.01012	0.00925	0.0806	0.291		66.2			5-30-21
240.02	0.00251	0.0020	0.01034	0.00921	0.0857	0.320		65.8	57.5	8.3	6-6-21
251.67	0.00227	0.0020	0.00967	0.00891	0.1002	0.298		64.2	58.5	5.7	6-13-21
185.58	0.00235	0.0020	0.00943	0.00868	0.0603	0.331		74.7	59.7	15.0	6-20-21
239.13	0.00194	0.0020	0.00834	0.00834	0.0094	0.303		85.9	60.0	25.9	6-27-21
232.24	0.00177	0.0020	0.00829	0.00843	0.0003	0.274		85.5	60.0	25.5	7-4-21
											Quarterly Fig.

ANALYSIS FORM

a measure of the operators in the department. It represents the operators' speed while working on productive work.

The columns headed by *Allowed Bs* are self-explanatory. The figures under *Department B-Hr.* measure the department as a whole (in contra-distinction to the values measuring the operators on strictly productive work). They are attained by dividing the "Productive on Standard" by the total hours of the producers. To obtain the 61 in the first line, 95,060 ÷1,561 = 61 (approx.).

The columns under *Non-productive Bs* are self-explanatory. So are the columns under *Division of Productive Payroll* and *Cost per B*, with one exception, the column *Standard Non-productive*, which is determined by observation. The columns under *Ratio of* are self-explanatory. The figures under *Supervision B-hr.*, which measure the supervision, are found by dividing the total actual B cost into the product of the department B-hr. and the standard total B cost. To obtain the value in the first line, 61 × 0.01773 ÷ 0.01077 = 100 (approx.).

The *Base of Supervision Premium* is determined by the ratio of trained help to new help. The *Premium Bs* equal the supervision B-hr. minus the "Base of Supervision Premium."

Under ideal conditions the figures in the three columns Operator B-hr, Department B-hr and Supervision B-hr should be the same.

ations should produce in each case a number of pieces such as to make an equal number of Bs in a given time. The number of pieces would be in this illustration approximately 13,860 and 115 respectively.

If in wrapping the small box the operator produces 18,000 pieces in a day of 10 hours, the productive value is 779 B (18,000 × 0.0433). As the value of the strain has been determined for the wrapping operations on both boxes, the same, or another operator should produce with equal application, skill and strength, a value, in working on the large box, of 779 B, or 150 wrapped boxes (779 ÷ 5.2). Because of the exact determination of strain in each case, a difference in the quantities of Bs produced would indicate a difference in application, in skill, or in strength.

In all lines of endeavor a human being should reap in excess of standard, namely 179. The other 25 per cent may logically be placed in a reserve fund to provide for the reward of indirect labor and supervision on the basis of their respective B-hr. or individual measurement.

Assume that on another day the same operator produces 16,000 pieces or 69.3 B in nine hours, and that during the tenth hour, because of shortage of material, lack of space or receptacles, breakdown of machinery or tools, or any other cause beyond his control, the operator is compelled to remain idle. Being an hourly worker, he receives pay for the idle hour, or the equivalent of 60 B, a total of 753 B for nine hours' actual work. The B-hr. value for the operator is then 77, but the B-hr. measurement of the performance of the department is 69.3. The analysis of the cause which com-

Dept. Sect. Week Ending

	NO. 1238		B-HOUR LAST WEEK 82			NO. 1246		B-HOUR LAST WEEK 38			NO.		B-HO LAST WEE	
	NAME Harry Duell					NAME John Russio					NAME			
Day	Hours	Total Bs	Scrap Bs	B Hour	Premium	Hours	Total Bs	Scrap Bs	B Hour	Premium	Hours	Total Bs	Scrap Bs	
M	10	840	–	84	1.26	10	464		46					
T	10	864	–	86	1.38	10	483		48					
W	10	902	–	90	1.59	10	390		39					
T	10	856	–	86	1.35	10	296		40					
F	10	830	–	83	1.21	10	455		49					
S	5	400	–	80	.52	5	290		58					
WEEK	55	4692		84.8	7.31	55	2508		46.7					

FIG. 2—PLANT POSTING SHEET

The cut shows two units of the posting sheet. General practice is to make the posting sheet large enough to contain postings of 18 or more operators. Operator No. 1238 is figured at a rate of 42 cents per hour. The record of operator No. 1246 is posted in red ink because his measurement is below 60. One of the methods used to encourage operators to pass 60 B per hour is to post all below 60 in red.

reward directly proportional to his productive effort, so that consideration of reward must enter into a proper system for the determination of remuneration. How reward is provided in the Bedaux system is best shown by continuing with the example used heretofore:

As allowance for relaxation has been introduced into the expression of the unit, the operator taking the normal amount of rest should produce, on any job, 60 B per hour. The operator who wraps 18,000 small boxes per day, aggregating an energy value of 779 B, exceeds normal by 179 B and his B-hr. measurement becomes 77.9. It is with the expectation that he will produce normally, or at the rate of 60 B per hour, that he is given remuneration at a given rate of say 30 cents per hour, a price representing the value of that skill normally exerted. The measurement of 77.9 B-hr. indicates two things: first, that he has exerted himself beyond normal and is therefore entitled to a reward; second, that by electing to produce more than standard he has compelled a performance above normal from those whose co-operation he must have in order to produce at all, *i.e.*, indirect labor and supervision. Their extra efforts in turn indicate that the operator is entitled to only a part of the remuneration for production above normal.

The reward to the operator may arbitrarily be placed at 75 per cent of the money value of the Bs produced pels the reduction from 77 to 69.3 permits the measurement of all branches incidental to production, and of supervision.

The measurement of supervision for a department is made as follows: The standard productive cost per B, the actual productive cost per B, the standard non-productive cost per B and the actual non-productive cost per B are determined. The two productive costs and the two non-productive costs are added in each case to give the total standard cost per B and the total actual cost per B for the department.

The department B-hr., obtained by subtracting from the operator B-hr. the units allowed for causes beyond the control of the operator, permits a comparison between actual accomplishment and possible accomplishment and gives the true measure of supervision when cost is taken into consideration. The measurement of supervision expressed in percentage, or as the ratio of standard to actual, is obtained by multiplying the standard B cost by the department B-hr. and dividing the product by the actual B cost.

It becomes evident that if a supervisor allows his department B-hr. to decrease through losses of possible production, his actual B cost increases beyond standard, automatically reducing the supervision B-hr. below the department B-hr. thus penalizing supervision by oblig-

ing it to accept less than the possible financial returns.

In principle the measurement of non-productive departments, when B values are not directly established for the work of the individual, is obtained in the same way as is the measurement of supervision. The only difference is that the B cost of operating the department affected becomes the principal factor in the calculation.

Inspection is another form of endeavor to be cared for. In the application of the B system inspection is divided into preventive and positive. Preventive, or floor inspection, is rewarded on the relation of department B-hr. to percentage of scrap, in a ratio making it more profitable to the inspector to have a department B-hr. of 60 with no scrap than a higher B-hr. with a scrap percentage above zero.

All operations of positive inspection have a B value that allows treatment similar to that of any productive work. B values on rejected pieces are of course higher than on accepted parts, which places rejection at a premium. But the salvage department, benefitting even more by sending back into process pieces erroneously rejected by positive inspection, prevents abuse. Thus a treble check, without decrease of possible production, is obtained.

Planning becomes merely the relating in detail of the B values of parts to be manufactured to the B capacity of departments, sections or groups, indicated by operator and department B hours.

Two forms are necessary in keeping record of accomplishment, an analysis sheet and a plant posting sheet. Examples are shown in Figs. 1 and 2. A careful study of them will indicate the quantity of clerical force required to keep the records for a plant of a given size.

Recapitulation

A recapitulation of the salient features of the Bedaux principle and system is afforded by these statements:

The principle aims to establish a standard of measurement of labor.

The essential part of the system is a relaxation curve, its values determined by trial. It is based on length of cycle of operation only but is supplemented by tables of added allowances controlled by sequence of motion and position of the body.

The unit of measurement of accomplishment, called a B, is one minute, divided into time for work and time for rest.

All computations are made in Bs. The actual money paid to a worker is determined by multiplying his hourly rate by the number of hours worked. It is given to him in an envelope. In another envelope he is given an additional amount determined by multiplying all Bs over standard by three-fourths of his hourly rate divided by 60.

There are no piece prices.

Supervision and indirect labor are rewarded for extra effort reflected in production.

Method and equipment do not enter into the system. (Improvements in method and equipment call for the setting of revised B standards.)

There is one unit to use in all records of production of individual and department. Two forms are necessary.

Painting Machine Tools White

By Frank C. Hudson

I am much interested in the experiment of H. Beckford & Co. in painting machine tools white, as told by Ellsworth Sheldon on page 1013, Vol. 55, of American Machinist.

I don't know when or where it originated, but the first place I ever saw it was in the Pittsburgh Locomotive Works in 1894. It was particularly striking there because of the smoky, murky atmosphere of Pittsburgh at that time, and also because it was not confined to a few machines. Every machine in the shop was resplendent in a coat of white. And, as the manager, the late D. A. Wightman, told me, "it saved its cost in bolts and nuts and other things which were hidden by the shadows on the floor near the machines."

Another experiment was at the old Bullock Electric Co., in Cincinnati, where every machine shone with a coat of aluminum paint.

The fact remains however that few places continue to keep machines painted white or in very light colors. The last paragraph of Mr. Sheldon's article ought to be perfectly true but experience hardly bears it out. At any rate I have never known machines to be kept painted white many years in any given shop. I've always thought I would do it in a shop of my own, but it never seems to last. Perhaps others know where it has.

Removing White Lead from Stampings

By I. B. Rich

All of the problems of making certain pieces of work are, unfortunately, not always confined to the piece itself. Such a case is to be found in the drawing of heavy brake drums for automobiles. On account of the heavy metal handled it is customary to use white lead as the drawing lubricant. The annoying problem is the removal of the white lead after drawing.

When white lead is mixed with linseed oil, as is frequently if not usually done, its removal is quite a task. If, however, the white lead is mixed with kerosene, any of the good cleaners, such as oakite, will remove it without difficulty. This will help considerably in preparing such parts as require a white lead lubricant, for further machining or for assembly.

Making the Latrobe High-Speed Twist Drill

Steel Rolled to Obtain Greatest Density at Points of Wear—Flutes Milled After Twisting —Drills and Shanks Assembled by Unusual Methods

By S. ASHTON HAND
Associate Editor, AMERICAN MACHINIST

IN THE manufacture of high-speed drills the Latrobe Tool Co., Latrobe, Pa., supervises the rolling of the steel from which they are made. Great care is exercised to insure that the steel shall be so rolled as to give high density to the points of greatest wear in the finished drill. For instance, in making a 1⅜-in. drill, an

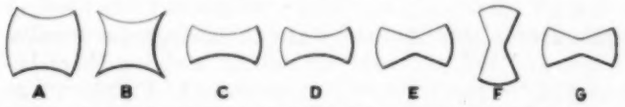


FIG. 1. SUCCESSIVE STAGES IN ROLLING THE BAR

8-in. ingot is cogged under a hammer to a 2-in. square bar and further working is done by rolling. In the first pass between the rolls, the bar is reduced to 1¼ in. square and in the second pass it is brought to the shape shown at *A* in Fig. 1.

The bar is then turned 90 deg. and rolled to the shape shown at *B*. The following passes gradually bring the bar to the shapes indicated at *C*, *D*, *E*, *F* and *G*. At *F* the bar is again turned 90 deg. and then back to the normal position for the last pass at G.

That the methods used in hammering and rolling, result in working the steel to a high density at what will be the lands and cutting edges of the finished drill may be seen by the micro-photographs in Fig. 2. The parts of the bar from which the specimens for the micro-photographs were taken are indicated by the black dots in the section diagrams at the left of each halftone.

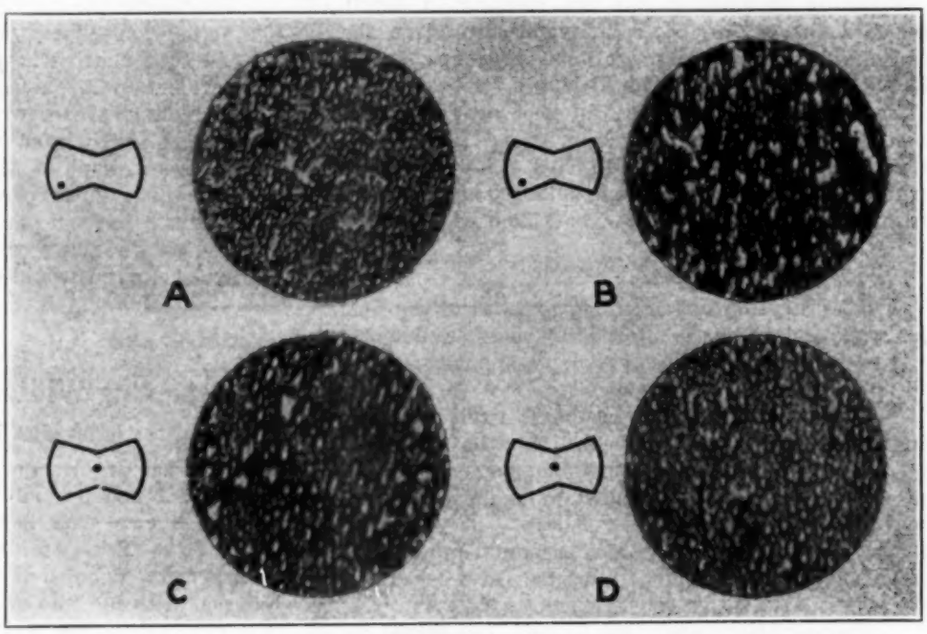


FIG. 2. MICROPHOTOGRAPHS OF CROSS AND LONGITUDINAL SECTIONS

Micro-photographs at *A* and *C* were taken from cross-sections of the bar while those at *B* and *D* were taken from longitudinal sections. The samples photographed were taken from an annealed bar which showed the following analysis: Carbon, 0.66; silicon, 0.20; manganese, 0.23; sulphur, 0.015; phosphorus, 0.013; tungsten, 18.15; chromium, 4.01; vanadium, 1.05. All the photographs show highly worked areas, with the carbides well broken up and evenly distributed.

The drill blanks are cut from the bar on a band saw and packed in pots with one-third charcoal and two-thirds sand for annealing. They are heated in a gas furnace to 1,700 deg. F. and allowed to soak for 10 hr., when the heat is reduced so they will cool to 1,200 deg. F. at the rate of 20 deg. per hour. At this point the gas is turned off and cooling takes place naturally and gradually.

Twisting is done by hand in a machine provided with a number of round plates having central openings of the shape of the rolled bar and free to revolve within an upright barrel. A hot blank is fed through the openings in the plates until the lower end enters a stationary die at the bottom of the barrel. As twisting progresses the stack of plates revolves. The motion of the lower plate is arrested by a pin bringing up against the end of a slot in the die at the bottom, giving the blank a certain amount of twist at the part in the lower plate. The bottom plate now being stationary, holds the bar at that point. As twisting progresses the second plate is brought to a stop, by a pin against the end of a slot in the lower plate and so on until the top plate is stopped, when the blank will be twisted to the helix angle determined by the location of the stop pins and slots. The blank is removed from the machine vertically by a twisting motion. By reversing the direction of motion, the apertures in the plates will be so aligned that the next blank can pass through them and enter the stationary die in the bottom of the machine. Twisting can then proceed as before.

Milling the Flutes

After the blanks have been centered, pointed and rough-turned, the flutes are finished to shape by a milling operation as shown in Fig. 3. This operation is one not generally done on hot-twisted drills, the flutes being finished by grinding and polishing.

The cutters for milling the flutes are relieved in a straight line instead of being eccentrically relieved, as is usual. The reason for this is that when eccentrically relieved cutters used on high-speed steel become dull, they are apt to be scored for a considerable distance

along the relieved part of one or more teeth; and in sharpening them by grinding the radial faces of the teeth, so much metal would have to be ground away that two or three sharpenings would be all they could stand before reaching scrap condition.

Sharpening a fluting cutter on the straight relief is

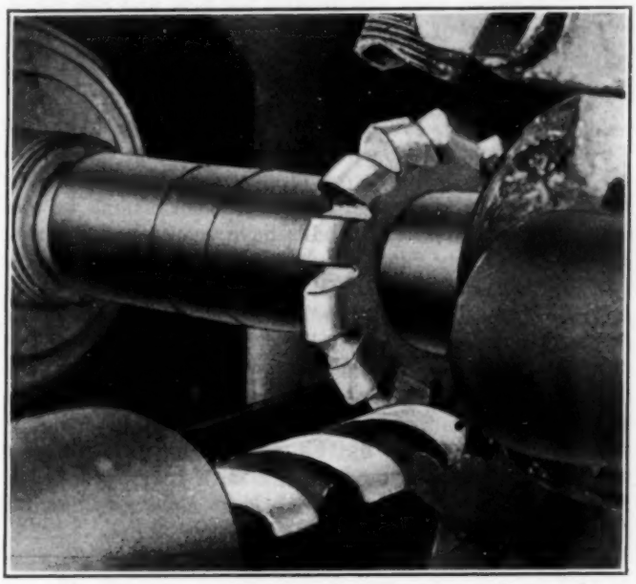


FIG. 3. MILLING THE FLUTES

shown in Fig. 4. The cutter is located on the stud *H* attached to the arm *B*, and the arm rocked while the top of one tooth is in contact with the abrasive wheel. Indexing from tooth to tooth and grinding the top of each sharpens one side of the cutter. The form of the cutter is not symmetrical and while the curves on each side are of the same radius their centers lie in different planes. In sharpening one side of the cutter it lies against the arm *B*. In sharpening the opposite side it is placed on a stud provided with a shoulder and is kept a certain distance away from the arm. Grinding each side of the cutter in different positions in relation to the arm *B* results in giving it the proper shape.

Milling the clearance on the drill lands is done in the usual manner. The setup and operation may be seen in

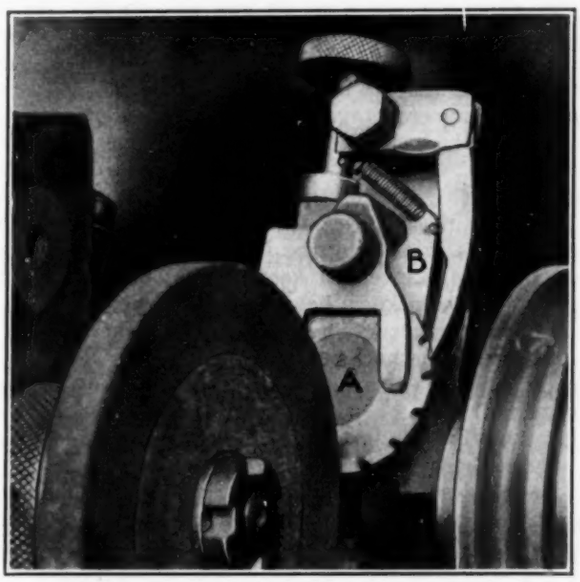


FIG. 4. GRINDING A FLUTING CUTTER

Fig. 5 very clearly and need no detailed description.

Twisted high-speed drills of the two-piece type are attached to their shanks by several methods, according to the size. Drills from $\frac{5}{16}$ to $\frac{7}{8}$ in. are electrically butt-welded to the shanks. From $\frac{7}{8}$ to $1\frac{1}{2}$ in. the shanks are counterbored to a taper of $3\frac{1}{2}$ in. per foot. The mating ends of the drills are turned to the same taper and have a series of fine pitch rings cut on them, very much like a thread without lead.

For drills over $1\frac{1}{2}$ in. the shanks, besides being counterbored to a taper of $3\frac{1}{2}$ in. per foot, are internally threaded on a Lees-Bradner thread milling machine. The mating ends of the drills are turned to the same taper and threaded to fit the shank, the operation being shown in Fig. 6.

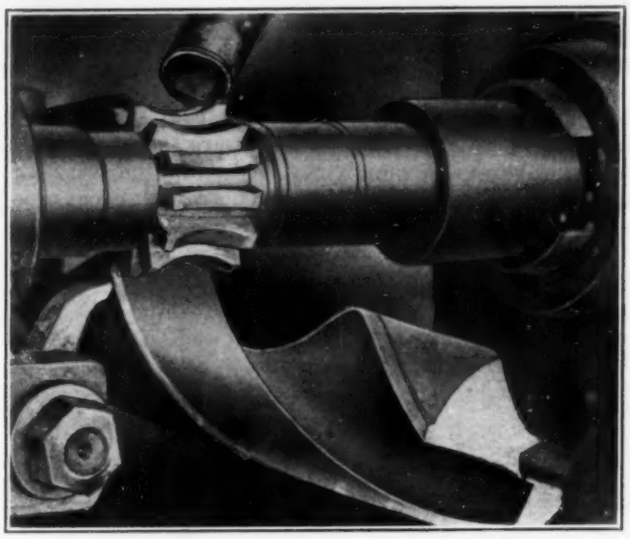


FIG. 5. MILLING CLEARANCE ON THE LANDS

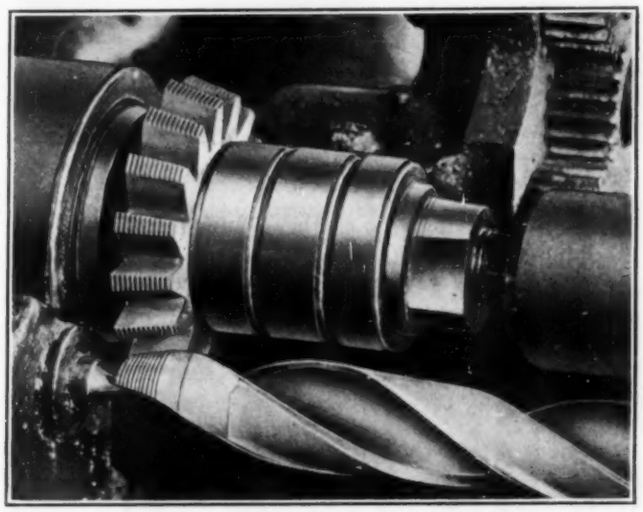


FIG. 6. THREADING FOR THE SHANK

In heat-treating, the drills are preheated to 1,500 deg. F., in a circular gas-fired furnace, and allowed to soak at the saturation point for about 20 min., after which they are transferred to the high-heat furnace where the temperature is raised to 2,500 deg. F. They are then quenched in oil. Tempering is done in molten saltpeter at a temperature of 1,100 deg. F., where the drills are held for about 2 min., after which they are sand blasted at the point where the sockets are to be attached.

Drills with sockets loosely assembled by hand are put

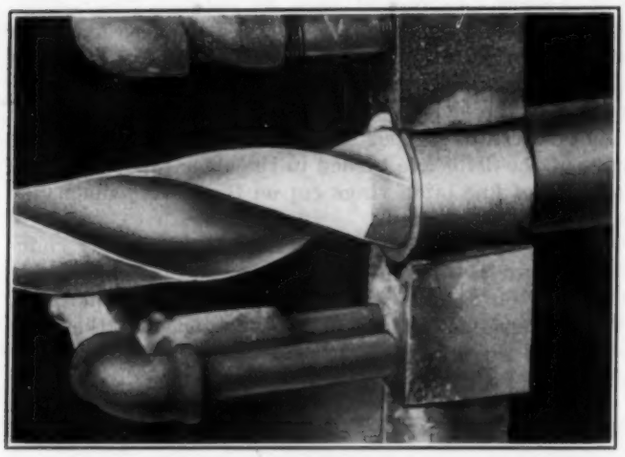


FIG. 7. HEATING IN THE SPOT-WELDING MACHINE

in a Thompson spot-welding machine, Fig. 7, and heated at the joint to 1,500 deg. F. They are then taken to a spinning lathe and rapidly revolved while the two spinning tools *A* and *B*, Fig. 8, are brought with great pressure against the joints, closing the metal of the shanks

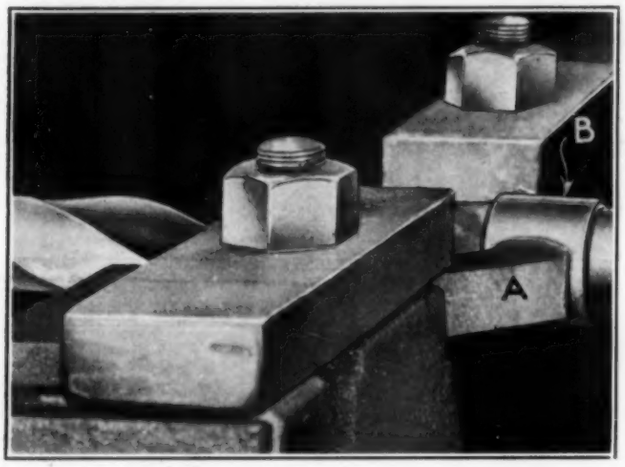


FIG. 8. ATTACHING THE SHANK BY SPINNING

tightly on the drills. To further insure the tightness of the joints they are brazed.

Heating in the welding machine requires about 30 sec.,

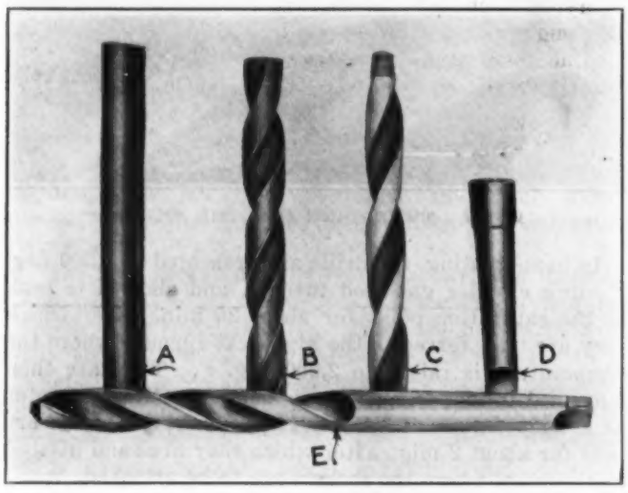


FIG. 9. SOME STAGES OF MANUFACTURE

and a surprising thing is that while the metal is brought to a red heat at the joint, the heat is communicated to the rest of the drill so slowly that the temper is not effected at any vital spot, and besides, the drill can be handled at the ends with the bare hand.

The drills are then thoroughly cleaned by sand blasting after which they are ground for size and clearance in the direction of their length, the amount of clearance being 0.001 in. per inch of length.

Grinding the Cutting Edges

Next the cutting edges are ground to shape on a Sellers twist-drill grinding machine and finally the trade mark and size are rolled in on the body next to the shank. At this point the drills have been somewhat annealed by heating in the spot-welding machine and the brazing furnace but are still quite hard and it is surprising to see how well the marking rolls stand up to the work.

In Fig. 9 is shown some of the stages through which the drills pass in the course of manufacture. At *A* is a blank as cut from the bar; *B* shows the blank after being twisted, and at *C* after fluting, milling the clearance and the threads. *D* is a taper shank with interior threads milled and the tang formed, while at *E* is a completed drill.

What Are the Worker's Prospects in the Machinery Building Industry?

By P. A. Fredericks

Referring to the article by A. W. Forbes, which appeared on page 667, Vol. 55, of American Machinist, the writer believes that the chart would be much more useful if plotted for "years of experience" instead of "years of age," and if the increase in wages was represented as a percentage instead of in dollars. A chart for draftsmen was published in an article by the writer on page 1069, Vol. 54, which will show what I have in mind. This chart was originally made to form a foundation for reasonable wage advances during the war period and was used as follows:

The man's experience was considered both before and after entering our employ. This was then checked on the chart against what he was able to do. As the chart was based upon data prior to 1914 the above method indicated what per cent he should have been increased in salary if conditions were normal. To this was added a percentage of increase to allow for the increase in the cost of living from the time he entered our employ. The index figure of increased cost of living was taken from the Bureau of Labor statistics.

That this method was fair and the data reasonably accurate was evident by the fact that we lost very few men that we wanted to keep during the entire war period. The men knew how their rates were arrived at and showed confidence in the fairness of the results.

The above method removes Mr. Forbes' trouble of having his "curves upset by the conditions of the past six years," and can be recommended from experience, if used with the judgment and discrimination necessary to any method of determining fair salaries.

It will be noted that for any given individual starting in our employ at any given date, the general chart could be modified by the cost of living index to produce the correct curve for that individual, and this was done in many instances.

The Training of Workers in Manufacture

II. General Conditions of Apprenticeship—Things Necessary for Training—Problems Arising from the School—Plant School vs. Part-Time and Continuation Schools

By J. V. L. MORRIS

THE argument for apprenticeship is briefly this: Such employments as have an extended and recognized field of practice and which enlist the better grade of workingman, utilizing both his technical knowledge and manipulative skill, and requiring an extended period of participation for mastery, and which can be embarked upon in the simpler processes by the immature worker, can be economically prepared for by apprenticeship. The patternmaker's and toolmaker's trades are outstanding examples suggested by this study. Another is the hand compositor's trade in the printing industry. There are, of course, the other somewhat similar trades of the shipbuilding industry and of the railroad shops.

In the Vocational Education Survey of Minneapolis the following reasons are advanced for apprenticeship:

"(1) A more careful selection of men who want to follow the trade results.

"(2) The apprentice advances into journeymanship with more interest in his calling.

"(3) The best time to get full knowledge of different machines and processes is while the learner is young. With proper apprenticeship training the youth learns best methods at the outset, instead of unlearning bad practices later.

"(4) Where school training accompanies shop practice, the youth gains technical mastery over processes which would otherwise be mechanical, and learns to adapt himself to changing conditions as the untrained machine worker never can.

"(5) Wider knowledge of all processes gives him an understanding, even in specialized work, which machine hands cannot have.

"(6) Apprentices of the future, if some better method of teaching can be found, will be not only all-around men, able to cope with every situation, but also men from whom the shop can obtain foremen and technicians.

"Modern industry may even complete an organization in which all the work is done by machinery made almost automatic and operated by machine hands, but will always have a need of the men who are masters of its processes to bind them all together and to direct the labor of the machine worker."

Conditions for Good Apprenticeship Training

It should be stated that the first requirement for satisfactory apprentice training is adequately varied shop experience under good shop instruction. Advocates of the continuation schools for trade training would frequently have one believe that the problem of instruction in the skilled trades is solved by the establishment of such schools. There is no attempt to belittle the utility of that movement in stating that the best of instruction in such schools will never make efficient mechanics without adequate experience in the manipulative phases of the trade, which under apprenticeship can only be obtained in actual shop production.

Two methods are possible to provide this shop experience. One is to provide a separate training shop equipped with all the standard tools of the trade, where general experience may be obtained for at least a part of the apprenticeship. The other is to arrange an orderly program through all the various types of employment at the trade in the regular production shops of the plant, under adequate supervision to see that the shop foremen do not interfere with the satisfactory learning of the trade by keeping the apprentice at jobs unprofitable from the standpoint of learning, or long after the process or operation has been thoroughly learned.

The separate training shop seems of particular importance in teaching the machinist's or toolmaker's trades, though where there is good co-operation from the production departments it may not be necessary. In one plant the apprentices are in the separate training department throughout their apprenticeship. In other plants the period is one or two years, after which they are placed at regular production but under supervision for varied experience.

A matter of prime importance is the quality of the apprentice supervisor. In many plants he has had technical training; but it is probably of greater importance that he have the qualities of a good teacher, a strong human interest in the apprentices, a thorough knowledge of the trades taught, and considerable practical experience in at least one of them himself. Also he should have a personality which will secure him recognition as being on a par with the shop superintendents.

Of almost equal importance is the quality of the shop instructors. It goes without saying that they should be first-class mechanics, chosen because of their liking for the work of teaching, and desirably given some instruction in their teaching. In the Santa Fe shops they are provided at the ratio of one instructor to twenty-five apprentices. A ratio of one to fifteen or twenty apprentices is sometimes recommended. In case there is no separate training department, their positions are usually those of assistant foremen or gang bosses.

For the supplementary instruction provided in the apprentice school there seems considerable variation in the amount of time allotted. In some plants only about two hours is provided per week; in others as much as eight hours is given to it. The usual practice seems to be about four hours a week.

However, it would seem that the amount should vary with the technical content of the trade. If it is the tool or instrument maker's trade, six or eight hours per week is not too much. If it is one of the maintenance trades or one where there is no necessity for acquiring skill in drafting, two or three hours per week may be sufficient for the phases of instruction directly related to the trade in hand.

In many apprentice schools there does not seem to be sufficient attention given to this relating of the school instruction to the trade involved. In many cases all are given the same course, no matter what their trade may be. If only machinists, draftsmen and patternmakers are concerned, there may be some reason in that prac-

tice, as the instruction in these trades should in large measure be similar; but blacksmiths and foundrymen have little use for some of the instruction in drafting and advanced mathematics and are frequently unable to grasp it, as usually they are boys with very meager educations. For them, coupled with fundamental trade arithmetic, there are possible units of applied science, iron and steel metallurgy and the like, which are both interesting and within their grasp, as explaining phenomena which they have observed in their own trades. However, the amount of this instruction required by them is very limited.

There is an opinion among many supervisors that there should be some instruction in the civic-moral field to combat the present industrial unrest, and to prepare the apprentices for their approaching duties as citizens, a matter which may be of greater interest to them at the time of apprenticeship than earlier when they were in public school. To quote from the 1920 report on trade apprenticeship of the National Association of Corporation Schools:

"A system for teaching industrial economics is of vital importance and would, if properly carried out, probably do more to create satisfactory industrial relations than any other single subject."

Of course the matter needs to be handled with much perspicuity, as there would doubtless lurk a suspicion of capitalistic propaganda in the minds of many of the boys, if the instruction were introduced in a school which they were attending under compulsion as a part of their apprenticeship. It should be said that, while practically no courses of this sort were found in the apprentice schools visited, the importance of the type of instruction was generally recognized.

General Instruction

The law of New York State, passed in 1919, establishing part-time and continuation schools, states that the courses of study "shall include among other subjects instruction in American history, the rights and obligations of citizenship, industrial history, economics, the essential features of the laws relating to the industries taught."

The report of the Committee on Education of the New York State Federation of Labor for 1919 contains the following item: "We recommend that courses of study be organized in history, civics, labor, health and compensation laws, and economics, under the guidance of the State Department of Education. If labor is to intelligently exercise its fullest political power, the members of unions and other wage earners should have exact and scientific knowledge of the subjects mentioned."

It is thus seen that both organized labor and the public education authorities endorse such instruction. The citations from the law for part-time schools of one state and from the recommendations of a committee of the labor federation refer primarily to public education, but are believed suggestive of the attitude of the public, and hence worthy of consideration in planning the program of an apprentice school whether under public or private auspices.

In several corporation schools there is an attempt to rate the apprentice on his qualities of character useful in his employment. These are, of course, but estimates of his instructors, supervisors and foremen, but may be highly useful in stimulating the apprentice's recognition of the relation between his work efficiency and his moral qualities, and to the management in selecting individuals worthy of promotion to positions of responsibility.

While adequate shop instruction is urged as of prime importance, the related work of the apprentice school is of sufficient value to recommend teachers of the first quality. Ordinarily they are technically trained, and usually have first-hand experience at the trades whose book phases they are to teach.

The formula $E = M + (T + I)$, borrowed from Bul. 52, Federal Board for Vocational Education, is a satisfactory means for expressing the desirable content in trade training, in which E represents the equipment in skill and knowledge required for efficient service in the trade to be taught; M the manipulative skill required either with tools or in the control of machines; T the technical knowledge essential in the particular trade; I the industrial insight or general trade content desirable as functioning in industrial efficiency.

In some cases it may be desirable to differentiate in the instruction the T, or elements of specific trade technical content in the particular trade, from the I, or those of general trade content. At least that seems the practice in several apprentice schools. The T instructor will be in close touch with the actual work the apprentices are doing, while the I instruction will contribute the factors of more general nature and common to all the trades taught.

In this practice there is sometimes urged a warning against "cold storage" teaching, i.e., of providing instruction which we believe will sometime be useful to the student, but which has no immediate application. There is much cogency in the warning, as there are apprentices who will become excellent mechanics, but who are incapable of assimilating instruction beyond that of immediate application in their work. The solution of the problem may be that worked out at the West Lynn plant of the General Electric Co., where an engineering school has been provided for the high-school graduates and simpler apprentice courses for those who have no aptitude for the advanced work. This has been shown to have been very successful in training the more capable, while offering ample opportunity for training the mechanic of average ability. The Westinghouse Electric Co. provides for the advanced instruction in a voluntary evening technical school. Many progressive communities provide the additional opportunities in public or semi-public evening technical schools.

The practice in the apprentice departments studied was to provide the classrooms inside the plant and as near the shop as possible. It should be noted that an extensive or expensive equipment is not absolutely necessary. For drafting instruction only suitable drawing space with materials are required, and for the other classes comfortable seats and a blackboard. Of course, it probably adds somewhat to the popularity of the apprentice department to provide equipment equal in quality to that of the public schools. In two plants moving picture equipment was available, as used for the mass education provided for all employees. Another has a projectoscope. The railroad-shop schools were stated to have gathered much illustrative material.

This additional equipment may be justified as placing the apprentice school on a par with the public high school, with which it must compete to secure the better type of boys, and for whom it offers equal or superior opportunities to the free public school. But it should be recognized that the apprentice is paying for all

elaborateness of equipment in the difference between the wages paid to apprentices and to those at regular production but with no supplementary instruction; for apprentice instruction must in general be a profitable venture in order to justify it to the directors of an industrial corporation.

The increasing practice seems to be to place the supplementary instruction during the regular working hours. There are some distinct advantages in this practice:

(1) It permits the full time utilization of school instructors most advantageously.

(2) It lessens the possibility of overworking the apprentices by requiring class attendance after they have been exhausted by their shop work, and provides for more time for recreation after work hours.

(3) More is accomplished in the school studies if the students are fresh, and it provides a welcome break in the shop work.

It should, however, be urged in favor of the after-work school:

(1) There is less reason for placing the school instruction during working hours with an eight-hour day than in the former nine- or ten-hour day. In one plant the shops ceased work at 3:45. It would be quite possible for these to provide from one to two hours instruction directly after work, and still give the apprentices time for some recreation. Another company where work ceases at five provides a lunch for the apprentices, after which an hour and twenty minues of class work is provided, which permits the boys to leave at 6:40.

(2) The after-work school permits the employment of instructors on a part-time basis. Usually in this way members of the engineering or drafting staffs or a skilled mechanic can be utilized for the instruction.

(3) There may be so much disorganization of the work of the plant by withdrawal of the apprentices for shop instruction, that the manufacturer may prefer not to employ any apprentices if part-time instruction is required, and an opportunity of learning a trade will thus be lost to the young men concerned.

(4) The apprentice must expect to pay by proportionately reduced rates of pay for his reduced production, resulting from being withdrawn from the shop to attend classes, for the overhead on his idle machine, and for the attendant disorganization of the shop. This disorganization is particularly apparent when, for example, an apprentice is a member of an assembling gang.

One solution of the problem devised at the Watervliet Arsenal is to require that the instruction shall be half on company time and half on the apprentice's, by requiring that on his instruction days he quit at six rather than five.

As the disadvantages seem greater when the apprentice is at regular production than when working in the training shop, it might be possible if a training department is utilized to provide the school instruction on company time while working in that department, and in the advanced years when at regular production, on the student's time. This would lessen the likelihood of over-fatiguing the younger apprentices, and still not unnecessarily disorganize production.

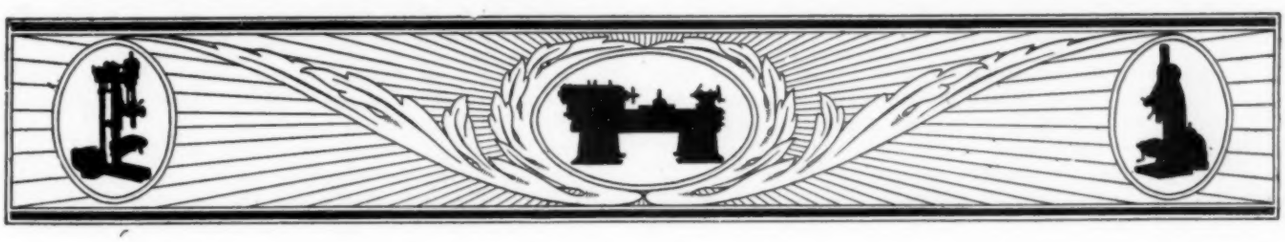
In the plants investigated, the apprentice schools provided by the company seemed in general markedly better than where provided by the public school authorities. Teachers conversant with actual shop conditions were employed. They could be enlisted from the personnel of the company or, if employed at full time, were selected for thorough competency. There was a more harmonious working with the company's administrative force, and a greater assurance of so arranging the apprentice's employment in the shops to assure optimum learning conditions. Moreover, the general management took a greater personal interest in the apprentices, which should assure their meritorious advancement when opportunity afforded.

Some arguments in favor of the part-time school provided at public expense are that it is held a function of the democratic state to provide, as one goal of its educational program, such instruction as will increase the vocational competency of its citizens. Also, the civic-moral instruction desirable can be provided by the authority of the state, presumably neutral as regards capital-labor conflict, without a suggestion of the capitalistic bias accompanying the corporation school. The expense of the instruction under corporation auspices is really borne by the apprentice, as it is to be expected that apprentice training will be a profitable enterprise and that the manufacturer passes on the costs of instruction to the apprentice by reduced rates of pay. In the smaller plants there are no facilities for instruction in the way of a drafting room and classroom and the small number of apprentices does not warrant the employment of an instructor, or properly supervising his instruction.

Somewhat the same discussion recommends that the classrooms be as conveniently accessible to the shops as possible inside the plant. There is little loss of time in passing from shop to school and no necessity is felt for changing from work to street clothes. There is greater co-ordination of school with shop instruction, and a single supervisor may direct both types of instruction. In some cases it may permit the employment of the same instructor for both the shop and school. This practice was noted in the shipyard investigated.

If, however, the plant has no available space or is hostile to supplementary instruction and unwilling to provide it, the public school may be utilized. This is, of course, recommended where there are too few apprentices to form a class or to differentiate the apprentices into classes suited to their varied attainments. In most cases under these circumstances one or two half days are taken for the instruction.

When after-work instruction is provided, one plant has arranged that the classes come directly at the close of work rather than in the evening. This practice is recommended when some or all of the apprentices live at a considerable distance from the plant.



The Power of Life Saving

An Appeal to the Economic and Social Sense of Management

By OTTO P. GEIER, M.D.
Director, Employees Service Department, Cincinnati Milling Machine Co.

THE power of life saving in industry was recently demonstrated to the public in an unusual way. Ten corporations of Cincinnati, through their group of industrial physicians and nurses, through a safety man and a workman, joined forces at the recent Cincinnati Health Exposition to demonstrate to the 100,000 or more visitors that medical supervision in industry is a vital factor in any health program, community or personal; that it is doing for the adult not only what medical supervision is doing for the school child, but that it is a great social and educational force for the employer and the employee, as well as engineering, medical, nursing and dental professions.

To our knowledge, this was the first attempt on the part of industry to crystalize in the form of a public exhibit the purposes and possible accomplishments of industrial medicine. The public ordinarily sees only the unfavorable side of industry as it reflects itself through press reports of labor disturbances and strikes.

This exhibit set forth the fact that the making of men is quite as important as the making of goods. It tried to prove that intensive health work in industry was a practical paying proposition in increased energy and good will, and as such was a big factor in the human equation between employer and employee. It set forth the principle that good business is based on justice and right; that men at heart are square and moved by the same human emotions; that all men seek leadership and that society fares well or ill depending upon whether the leadership that appears is sane, intelligent, constructive, or whether it is irrational and destructive; that the employer is largely responsible for the type of leadership that prevails in our communities; that the right and wrong of our present industrialism so thoroughly permeates our individual and collective thinking that we are right or wrong in our mass consciousness just to the degree in which industry succeeds or fails in establishing high principles of action and deserved leadership.

FIG. 1. A MINIATURE SHOP SHOWING UNSAFE, UNCLEAN WORKING CONDITIONS

They are the cause of frequent accidents and unnecessary illness. They are generally accompanied by wasteful methods, careless treatment of employees, and a slipshod wage system. The combination produces constant dissatisfaction and irritability in the shop and at home.

Wise men know that enormous effort is being made both from without and within, to infect our citizenship with the stagnating liberty of Russia. Wise men see that class-consciousness most easily permeates where industrial strife is most constant. The present unemployment situation has furnished fuel to the fires of discontent. Who knows when this country will again be fully employed? How long can we stand the new competition of the disordered world status? Will we not need every pound of possible energy out of millions of well-minded co-operating workmen, working under sober, fair minded, capable industrial management, to preserve our industries and national being?

The far seeing industrial leader knows that we cannot secure the needed energy and co-operation, the willingness to produce, out of men whose bodies are cramped by sickness and whose minds are twisted and poisoned through seeming injustices, through unnecessary suffering by injury and ill-health. The intelligent employing groups know that the new competition will not permit the wastage of millions weekly on account of preventable illness and accidents. This country could perhaps stand this loss when the products of its natural resources were finding ready markets the world over, but not now.

We must stop the leaks—all the wastage, not only industrial but public and political. Big men are needed everywhere, to think, to plan for the people as a whole, to assume leadership, for then and then only may we hope that your America and mine may hold its place and yet prove again the wisdom of our forefathers in founding this democracy. Are the industrialists meeting this challenge for leadership?

Many industries have shown their ability and leadership by instituting far reaching health programs within their walls, but the public and the medical profession

have never been given a composite view of this very advanced health work as was done through the Industrial Physicians' exhibit at the Cincinnati Health Exposition.

The Workman Speaks

Color and action were given to the exhibit in that machinery was in motion in the two contrasting miniature workshops, shown in Figs. 1 and 2, where machine operators, taken from factories, held the attention of the visitors all through the afternoons and evenings by their constant comments on the advantages and disadvantages of their respective working conditions.

The man in the overalls held the stage not to decry working conditions but to constructively criticize the good and the bad in present day methods of production and in simple language to point the way to safer, healthier working conditions, with a larger output per man, with better wages, with less injury and sickness, with friendlier relations between employer and employee, with lesser burdens on society and with better citizenship throughout. The shower of sparks off their respective emery wheels always drew a crowd to the rail in front of their little shops. Then each in turn would enliven his audience with the feelings that come to workmen as they face their daily jobs, explaining how these feelings are influenced by the conditions under which they work, how they affect bodily and mental vigor, how they affect their output in the working hours, and finally how they influence their behavior to their families and to the community at large after working hours.

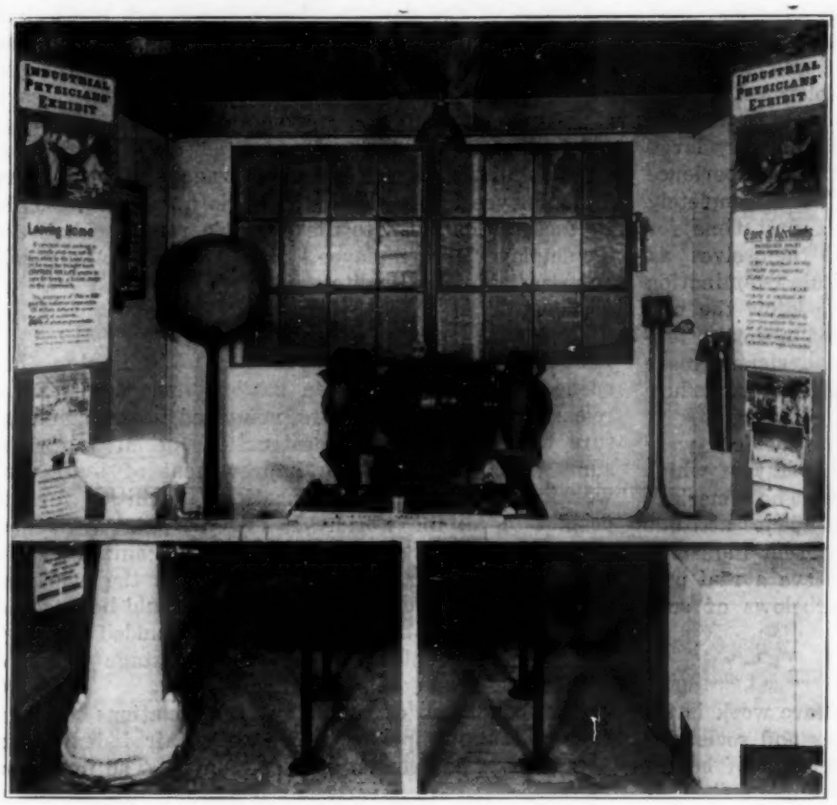


FIG. 2. A MINIATURE SHOP SHOWING SAFE, SANITARY WORKING CONDITIONS

Proper lighting and ventilation are provided. So are reasonable comforts and conveniences. A fair wage system is in use. The results are team work, fair play, good shop government—in a word, good citizenship. Compare this shop with the one shown on the opposite page.

To begin with, this was a joint exhibit of the work of ten companies in this vicinity employing full-time physicians. Upon my able associate, Dr. C. L. Ferguson, fell the many weeks' task of gathering medical, surgical, dental and employment data upon which were based the posters and graphic representations used in the eight booths of this exhibit. Two of the posters are reproduced in Figs. 3 and 4.

Our general plan was to give the public a composite view of industrial medicine as it was practiced in the ten plants, presenting the average conditions rather than the advanced work done in any one or more of the plants. It was interesting for instance to note that 11,800 physical examinations were made in all in 1920; that the average percentage of rejections was 5.7; and that rejections varied from 1.2 to 8 per cent.

It was impressive to note that among 11,800 employed, 70,000 medical cases and 35,000 surgical cases visited eight industrial dispensaries, making a total of 250,000 visits and revisits for all causes.

Some of these industries reported that as high as 7 per cent of the working force daily sought the physician's aid for one reason or another. The average ratio of medical to surgical visits was as 7 is to 3.5. The collected data showed on the other hand that almost invariably the sickness rate and absence because of sickness were materially reduced, in some instances being cut in half; that lost time from infected wounds, after installation of medical service, with its prompt and proper treatment, reduced infection cases to the negligible point.

In compiling statistics of this work one cannot escape the indisputable fact that *industrial medicine* is *preventive medicine practiced on the firing lines;* that the daily supervision, the frequency of observation, the early diagnosis and prompt treatment constitute the sanest and most economical way of preventing human wastage; that they keep the front line of industrial attack and maximum production intact; that they are the best means yet devised for keeping the old time "evacuation stations" or hospitals and clinics free from overflow of chronically incapacitated dependents; that to reduce the size of the human scrap heap most systematically we must move more of our scientifically trained medical men up to and on the industrial firing line.

Organized Labor's Position

Organized labor has, in the main, raised objection to physical examinations and medical supervision in industry, claiming that too many men are thereby thrown on the human scrap heap. Further, that industry is largely responsible for the physical defects in individuals and that society must see to it that these individuals also be given a chance to provide for themselves, that the unfit must be carried along with the fit at the cost of industry.

Answer has been made to this position that labor gains nothing by being ignorant of its physical impairments, that the making of physical examinations is the first and fundamental step either toward physical restoration or proper placement in jobs suited to the individual. Furthermore that society gains in knowing the size of the human scrap heap and what factors contribute to it so that legislative and other steps may be taken to prevent human wastage.

However intelligent consideration of the subject now brings nearly all of us to the view that the making of physical examinations is a decided step in the conservation of human life—that the mass of workers in any plant are entitled to protection against the spread of contagious disease that comes with this practice; that the hazard of having operators of machines, cranes and other transporting methods subject to epilepsy, heart failure and defective vision cannot be tolerated.

Physical examinations by industry hold a serious lesson for the medical profession in that a very large percentage of the men examined report this experience as the first time that they had ever been completely examined by a physician. It is also a first time for them to become really interested in themselves as physical entities. With this physical examination comes a larger interest in the desire to know the real basis for any illness, an earlier seeking of medical attention, a greater willingness to employ physicians more frequently and to submit to surgical and other procedure when necessary.

When labor was scarce all manner of devices were used by industry to attract the worker, many of which were socially and economically unsound. The American workman fortunately has an independent attitude toward *coddling welfare* work. The present industrial depression, unfortunate as it is, will serve a real purpose in eliminating the frills and furbelows of such welfare work.

Work Here and Live Longer

In strong contrast to the useless welfare work is the real service that is rendered the worker and society in providing good working conditions, stability of health, the reduction of suffering and loss from disease and accident that usually attends intelligent medical supervision. The far-seeing employer has not scrapped the services of the medical department in these parlous times, but recognizes that the physician can make a real contribution to a better morale and the necessary higher output per man at lower cost, that is so greatly needed at this time. Work here and live longer is a sane democratic appeal to the best type of employee.

Absence in industry on account of illness varies from 3 to 8 per cent. Industrial medicine can reduce the absence on account of illness to 1½ per cent, perhaps even lower. Accepting the lower figure of 3 per cent as the normal and 1½ per cent as the attainable through medical supervision, we should save for each worker 4½ days of earning power each year. The 11,800 workers who made nearly 250,000 visits in 1920 to the seven industrial medical departments were diagnosed early, sent home when incapacitated for work, advised to consult their family physicians, and where necessary, referred to specialists. These 11,800 workers, saving 4½ days each at an average wage of $5, would experience a total saving of $265,500.

The thoughtless employer blames the labor agitator for most of the radicalism that appears in the ranks of labor, giving little thought to the fact that he may be quite a contributor to that state of mind. The employer too frequently forgets the enormous advantage that he holds over the labor leader in that he, through his organization, is in daily contact with the worker, whereas the radical labor leaders' contacts are but intermittent. Too few employers appreciate that the unclean, unsafe shop where the foremen and executives drive rather than lead their men—where even the common garden variety of human considerations, comforts and conveniences are missing is also the shop where the men's minds are daily poisoned against organized industrial leadership, and conversely therefore opened to any other leadership that may offer. It is during the working hours of the day that men's minds are most alert and receptive. It is important therefore that the impressions that are hourly being made upon those minds should be free from fair criticism. Unnecessary and frequent accidents, preventable occupational hazards, thoughtless treatment of employees, wasteful methods of production, slipshod wage systems, where the employee is unable to check his own earnings, are all factors that lead to disagreeable relations between the employer and employee and add to the age long gulf between labor and capital.

Better Citizenship

The Disarmament Congress at Washington has spelled a new era between nations and promises the release of billions of dollars, now used in the manufacture of instruments of destruction, permitting these sums to be used for the improvement of living and working conditions and educational facilities for the peoples of all the world. It may be said with equal truth, that if organized labor and organized capital could also be disarmed to the end that the ever constant strife between these two groups could be lessened, billions of dollars in added production, added earnings, would take the place of the fierce wastage that now occurs because of this constant strife.

The condition of industry, the relations between employer and employee, are a very fair index of the character of any country or community. The individual employer too frequently forgets that his particular industry is but a part of the whole and that the character of relationships that exist between himself and his men leavens the state of mind that exists between the employing and employed classes of his community, and that the general quality of the citizenship of which his men are a part, is raised or lowered, depending upon whether or not he, through his organization, is producing happy contented citizens.

It cannot be denied that clean working conditions, reasonable comforts and conveniences, a fair wage system, and considerate personal relations throughout the working hours, produce a state of mind, a shop spirit, a certain morale, that makes for a feeling of responsibility throughout the organization, an appreciation of the necessity for organization, and the part that each must play in such. Out of this feeling of mutual trust and confidence there grows a respect not only for the industry but for society as it is organized, and a better quality of citizenship is the net result.

The consideration of the health of the worker is but one factor in the important personal relations program, but it goes a long way to help make men sane both in body and mind. You cannot build up contented citizenship which is suffering from unnecessary illness and

YOUR FRIEND
"The Eye-Picker"
A well meaning workman with greasy hands, soiled rag, dirty tooth pick, or some other pet pick, makes a stab at the foreign particle endangering your eye to infection.
Your handy friend wont look so good to you when your eye goes blind.

FIG. 3. WHY IS THE AVERAGE MAN SO CARELESS OF HIS EYES?

SOME DAY I'LL LOSE MY HEAD - AND I'LL GET EVEN WITH HIM!
HE'LL HIT ME ONCE TOO OFTEN!
I'VE LOST MY TEETH - JUST WATCH ME GIVE HIM THE SLIP!
WHEN IS HE GOING TO GIVE US A REST
AGED AND INFIRM TOOLS
Scrap Bad Tools
Cracked dull, mushroomed, broken or worn out tools cause
7% OF ACCIDENTS
A flying chip may cause the loss of an eye.
Soldiers never go to battle with faulty arms.
Workmen, using worn out tools, take chances forbidden on the battlefield.

FIG. 4. THE BAD TOOL BRIGADE THAT SHOULD BE DISCHARGED

injury. Many of the so-called grievances can be traced to a physical basis. Not the least satisfaction that should come to the intelligent employer, in creating a good shop morale through these various methods, should be that he also creates thereby happier and more contented conditions in the homes of his employees. And thus is effected an even wider circle of citizenship.

The dollars and cents value of the prevention of unnecessary accidents has been so thoroughly proved by the National Safety Council that little need be added in that direction. What the employer has failed to sense, however, is that enormous savings can be made by the prompt and efficient treatment of all accidents as they occur and that the installation of a medical department in industry has long ago been taken out of the charity welfare class. The immediate attention to injuries by men especially trained in that work, not only reduces the number of infected cases to practically nothing, but greatly shortens the period of disability, reduces unnecessary pain, reduces the loss of wages, and of course adds to production.

There is some danger, now that industry has allowed a fixed charge in its budget to cover the cost of industrial accidents through workmen's compensation acts, that it feels that its responsibility in this direction is closed. We do know on the other hand that a great percentage of accidents and their expensive sequels are largely preventable and that these present fixed costs might well be reduced by one half. It is time that industry wake up and supply the leadership that will make of the state compensation commissions great social agencies for the prevention of accidents and for the proper treatment when they occur and thus save to society the present waste of men and money.

Leaving Home

An interesting illustration, used at the exhibit, shows a happy workman leaving his home in the early morning hours, waving "Goodbye" to his wife and children. In Ohio, each year approximately 4,000 such men wave their goodbyes in the morning, never to return alive. Thousands upon thousands more are brought back home crippled for life and unable to care for their families, which even though they receive compensation for permanent disability, are most likely, in the end, to become a future charge on the community. In the same way, $5,000 or $6,000 as compensation for death on account of injury, merely cares for the family temporarily, but permanently takes out of the community a productive citizen who was not only providing for his family but was adding to the total wealth of that community. Good health, good shop spirit, good relations and good management go hand in hand. With the establishment of this new specialty, industrial medicine, and the placing of the physician in industry, medical attention has for the first time become daily and conveniently accessible to the adult. Intensive preventive medicine applied to the individual here becomes possible. It is sought by 7 per cent of the working force each day in some industries. To supply such service costs from $5 to $12 per employee per year. The fact that the best managements in the country have continued this service indicates that it must pay for itself. Poor health is a drag on employee and management and spells the idle machine, lost wage and production, in all three of which society is vitally interested. Good health, of course, means exactly the reverse.

Increased Confidence in the Leadership of Management

The space here allotted permits the telling of but a fraction of the effort made to show the public the interest that industry has in the life saving program. The Health Exposition at large tremendously stressed the power and values in good health. Industry in general should sieze upon the opportunity that this type of work offers to improve its relations with the worker and its position with the public. In these days of the increase of repetitive processes management must solve the problem of better interesting and satisfying the mind of the worker. Increased confidence in the leadership of management cannot come through the fat pay envelope alone. A shop spirit, a personality, will tend to satisfy the workers' desire to escape the dulling effect of machine processes. To institute measures that meet some of his basic human needs will be of assistance, and of these none is more basic than an interest in the health of his mind and body.

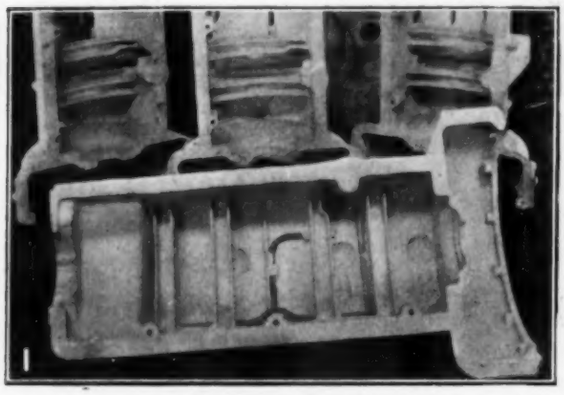
Machining the Mack Crankcase

An Unusual Milling Cutter—Zylol Used for Detecting Cracks—Methods of Boring and Reaming—Gages for Final Inspection

By Fred H. Colvin
Editor, American Machinist

BOTH the upper and lower crankcases of the Mack motor are of aluminum, the lower portion having oil distributing pipes cast in place, as can be seen in Fig. 1. There are also oil troughs under each connecting rod which serve to strengthen the lower crankcase very materially.

The first operation in the upper crankcase is to drill the corresponding oil tube holes, after which the joint surface is milled as in Fig. 2, and then the cylinder block surface as shown in Fig. 3. Fig. 4 shows the milling of a type of crankcase used on the larger motors.



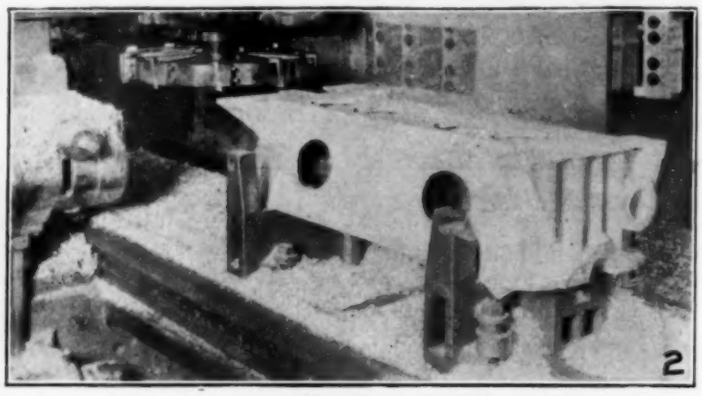


FIG. 1. CRANKCASES SHOWING OIL TUBES. FIG. 2. MILLING CYLINDER SURFACE

The holding fixtures, shown in Figs. 2 and 3, are of very simple design and the milling cutter, designed by L. S. Ayer, factory manager of the Plainfield, N. J., plant, is clearly shown. Details of this cutter are shown in Fig. 3. The cutter is 22½ in. in diameter and has ten teeth. The teeth are set at an angle of 10 deg. and are held in place by two screws, as shown. The heads of these screws lie in a pocket provided by the shape of the outside of the cutter head and do not project beyond the outside diameter of the cutter head itself. Fig. 2 also shows the protective screen used to prevent the chips flying as the cutter plows through the work.

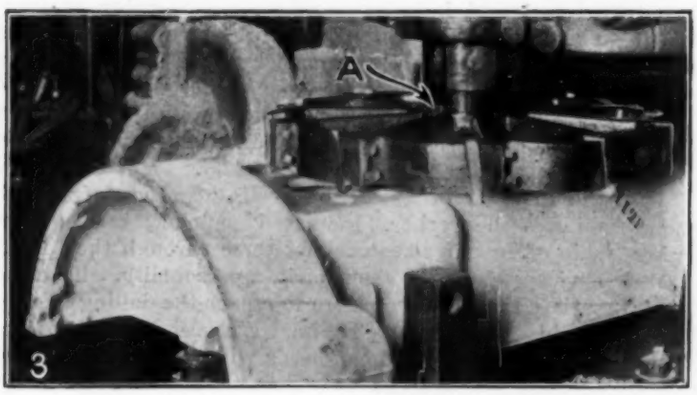
Fig. 3 gives a closer view of the milling cutter and shows the key by which it is driven at *A*. It also shows the cylinder surface being milled near the flywheel end. A somewhat different fixture and also a smaller chip guard is shown in Fig. 4. This fixture provides support for the bolt flange of the crankcase at *A*.

The eight valve guide holes are drilled in the jig shown in Fig. 5. Here the crankcase is carefully located sideways and raised against the under side of the jig as shown. A little study will show the various features of the jig and it will be noted that hooks are provided for lifting it from the machine.

The bolt flange is drilled under the large multiple drilling machine, shown in Fig. 6. Here again the design of the fixture can be studied to advantage. The crankcase is supported at four points in a sort of cradle which slides under the large plate carrying the drill bushings, and is then raised into contact with it.

Then come several milling and drilling operations, after which the crankcase is bored for the crankshaft and camshaft bearings, together with the starter holes. This boring is done in the fixture shown in Fig. 7, on a lathe provided with a special driving head. The construction of the holding fixture can be readily seen, while neither the boring bars nor their guides need any special comment.

The crankshaft and camshaft bearings are then care-



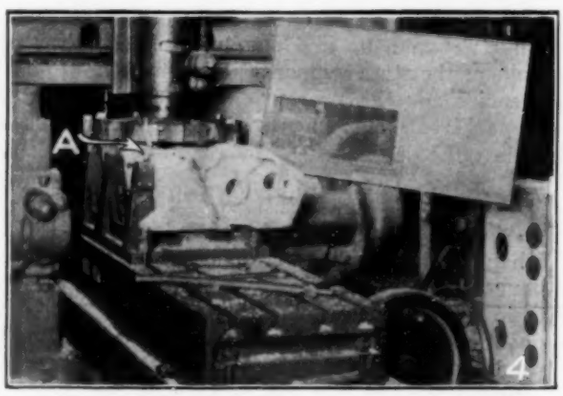
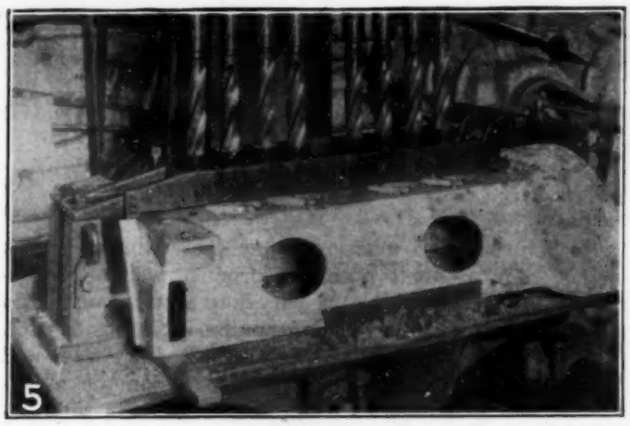


FIG. 3. THE MILLING CUTTER. FIG. 4. ANOTHER MILLING FIXTURE



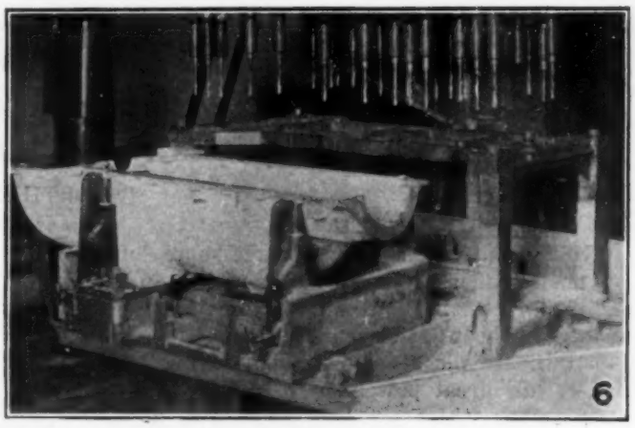
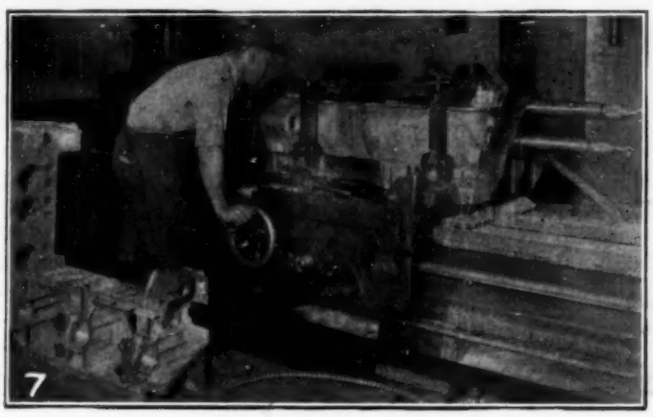


FIG. 5. DRILLING VALVE GUIDE HOLES. FIG. 6. DRILLING THE BOLT HOLES

fully hand reamed as shown in Fig. 8, the loose connection between the wrench and the boring bar effectively preventing any unusual side stresses during the reaming operation. This view also shows (in the background) the construction of the driving head for the which may have developed and which have escaped all previous inspection and prevents the possibility of sending out crankcases which may soon develop cracks from flaws in the castings themselves.

The final mechanical inspection is done on the bench



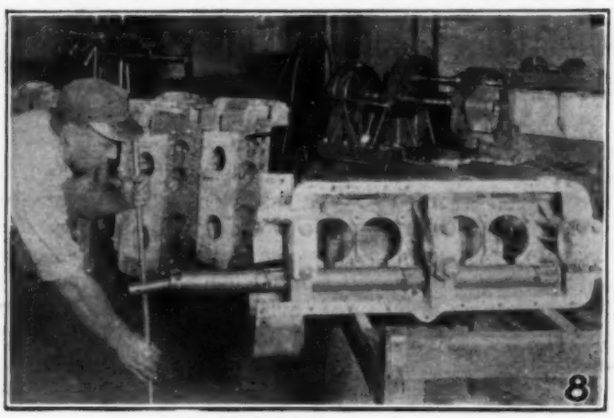
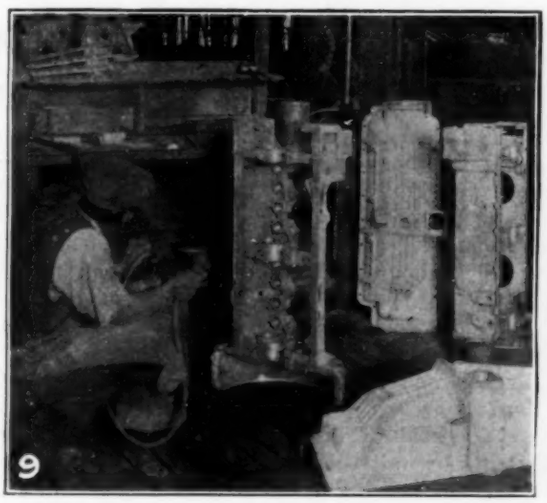


FIG. 7. BORING FOR CRANKSHAFT AND CAM SHAFTS. FIG. 8. HAND-REAMING THE HOLES

two crankcase boring bars which were designed and built especially for this work.

After the crankcases have been completely machined, they are lightly painted with a thin water paint after which they are sprayed with Zylol under pressure, as shown in Fig. 9. This instantly detects any cracks shown in Fig. 10, where all the important dimensions are carefully checked by means of the various gages shown. Included are surface gages, plug gages, snap gages, special locating gages, and a gage for the cylinder bolt holes as shown at the right. They provide for a very complete inspection of every detail.



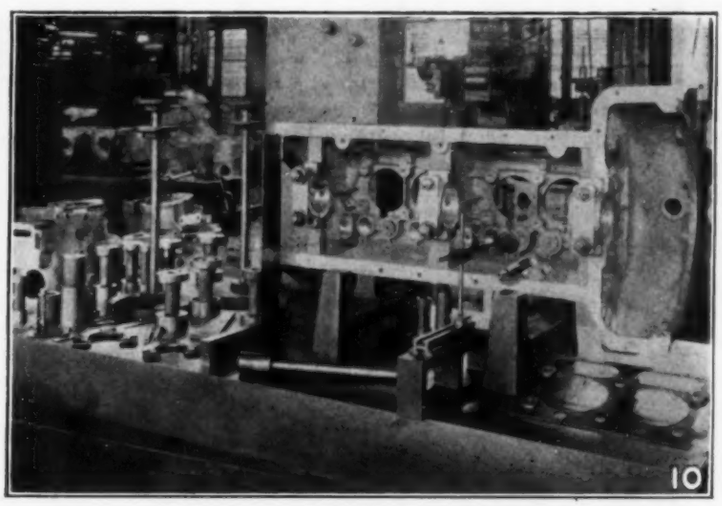


FIG. 9. INSPECTION FOR CRACKS. FIG. 10. THE FINAL INSPECTION

Japan As a User of Automatic Machine Tools

About Two Hundred Automatics Now Being Used—Increased Use Will Become Imperative —The Japanese Are Realizing the Advantages of Automatics

By ARTHUR JACKSON
Tokyo, Japan

JUST as an expensive and scarce supply of labor has made America the leading nation in the world manufacturing and using automatic machine tools, so has a cheap and plentiful supply of labor made Japan the smallest user of labor-saving machines of the world's great powers.

At present there are only about two hundred automatic machines used in Japan.

Geographically, Japan is placed in Asia in relatively the same position as is England in Europe, and with China, Manchuria and the rest of the East becoming more and more modernized, therefore demanding manufactured goods in greater quantities every year, Japan is in an ideal location. Her natural mineral resources are not great, but her cheap electric power, cheap and willing labor, and splendid mercantile marine counteract any deficiency that she has in mineral resources.

Japan Has Good Markets

Not only has Japan a good external market near at hand, but she has a good internal market for manufactured goods, for each year sees her take a great step forward in Western modes of living. In all her cities immense modern buildings have been and are being erected, the streets are being widened and paved, and the disgusting practice of carting human feces through the streets is fast giving away to the modern system of water sewerage. At present automobiles and motor trucks are not really practicable in the cities, but national highways are being planned, and when they are realized there will be a big demand for motor cars and trucks.

Japan is one of the leading nations of the world in the use of electricity. Almost every house, whether it be palace or hovel, is lighted by this means, and it certainly seems queer to see an electric light burning before an idol in the country shrine. Electric fans are in general use, and electric irons and cooking devices are becoming popular.

Japan suffers severely from earthquakes and floods, the latter being the more terrible, for every year there is a great loss of life and property from this cause. At the time of writing over three hundred lives have just been lost by flood in southern Japan. Fires also play great havoc in Japan. Last winter there were several villages destroyed, and in Tokyo alone there were over five thousand houses burned. It may be asked in what respect has all this to do with automatic machines. The answer is that Japan, in order to finance big schemes for the prevention of flood and fire, and also to raise her standard of living, must rely more and more upon her industrial progress, as her agriculture does not properly support her present population.

America, Great Britain and France are her greatest competitors in the rest of the Orient. In fact Japan at present is hardly able to compete with them either in prices or in quality, although her workmen are the lowest paid. The reason is not far to seek, for although the other countries mentioned pay their workmen high wages, they are better able to produce well and accurately finished articles at a very low cost because they use automatic machines and other labor-saving devices. The Japanese engineers are well aware of this fact and previous to the present financial depression the manufacturers commenced to order large numbers of automatic machines. Most of the machines ordered were bar-working machines and now most of the leading factories have planned to install automatic machines for chuck work and automatic milling machines.

The principal argument that the Japanese have against an automatic machine is that a long time is required to set it up. The writer has been able to demonstrate that in many instances on the modern automatic machine work can be set up and the first piece machined in much quicker time than is possible on hand turret lathes, and the same piece of work can be set up and machined quicker on a hand turret lathe than is possible on an engine lathe.

The practice of having one man attend to a battery of several automatic machines does not seem to appeal to the Japanese, as they usually prefer to have a man attend to each machine, but as the workmen improve and wages become higher and labor more scarce, the practice of having a man attend to more than one machine will become general. The Kawakita Deuki Co., of Osaka, which has had three automatics running for several years, making small motor parts, has two men tending the three machines. The time taken to produce the particular piece of work on these machines compares very favorably with the time taken on the same work on the same machine in America.

Some Japanese Plants

The Nippon Seiko Kaisha, Ltd., manufacturer of ball bearings, is hardly able to compete with those of foreign make in spite of the heavy duty on the latter. This company is now making plans to equip its plant with automatic machines and bring its manufacturing methods up to date. A number of the large textile machine builders are about to do the same.

Factories are being erected for the manufacture of the Diesel oil and other internal-combustion engines that are being used in increasing numbers on the fishing boats and other vessels. Airplanes and hydroplanes are being built, and the manufacture of various articles usually purchased abroad has commenced, all of which calls more and more for automatic machines.

Japan has reached a point where she must either go forward and use up-to-date, modern, labor-saving and accurate machine tools, or rely on obsolete inaccurate, hand-operated machine tools and so be hopelessly outclassed by her well-equipped rivals in the engineering field. Japan, who in the recent past has been very quick to take hold of our methods, will not fail to grasp her opportunity at this time. The more she extends her engineering activities the more she will require to import up-to-date machine tools and the better customer of America she will be.

Department Layout in the Colburn Shop

Arrangement for Machining, Erecting, and Testing Units and Complete Machines—Toolroom Arrangement and Heat-Treating Department—Lavatory and Coatroom

By FRED. H. COLVIN
Editor, American Machinist

THE center aisle with its industrial railway track, shown in Fig. 1, is taken from the opposite side of the shop from that of the view shown in a previous article. This view shows something of the arrangement of the different bays; the traveling crane at *A*, one of the department foreman's desks at *B*, and the general foreman's desk at *C*. The heavy duty drilling machine department is shown in Fig. 2, where also may be seen the steel barrels used for holding work that comes from the machines. These barrels are provided with trunnions which make it easy to pick them up on suitable trucks and move them to any desired point. This view also shows a surface plate at the end of the aisle for inspection of any work which may require it.

The gear cutting department is shown in Fig. 3, which gives a particularly good idea of the saw tooth construction of the roof, and the lighting secured by its skylights.

The toolroom is at the end of the building and the lighting is especially attractive as can be seen in Fig. 4, which shows the individual motor drives, the use of individual toolracks or stands, and gives a fair idea of the arrangement of the machinery in this department. Individual work benches with their ends against the

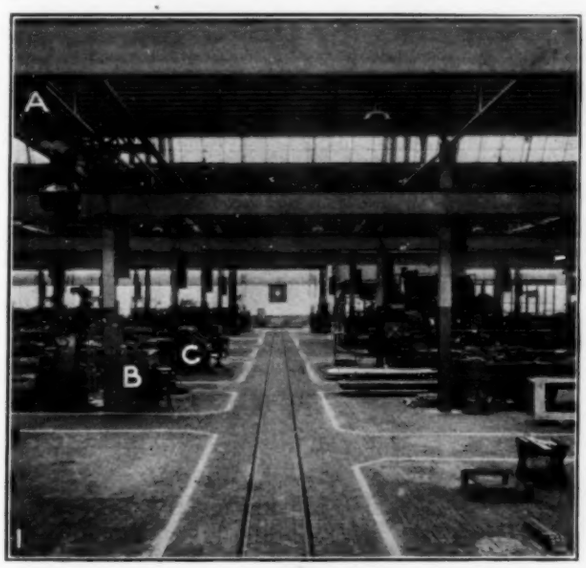


FIG. 1. ALONG THE CENTRAL CROSS AISLE. FIG. 2. HEAVY DUTY DRILLING MACHINE PRESS DEPARTMENT

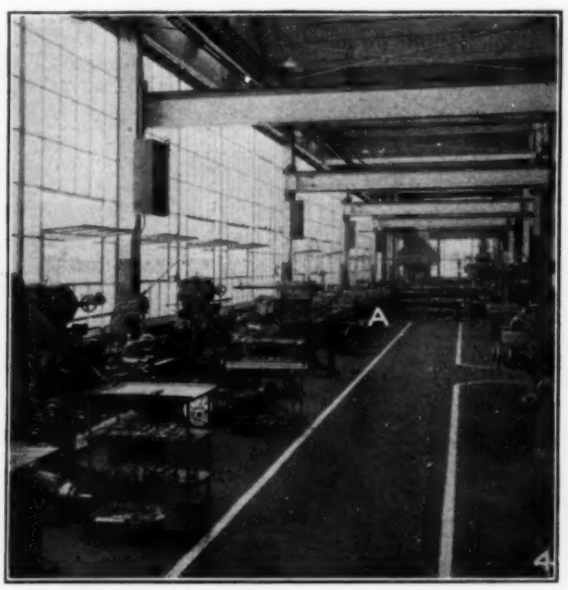


FIG. 3. THE GEAR CUTTING DEPARTMENT. FIG. 4. THE TOOLROOM ARRANGEMENT

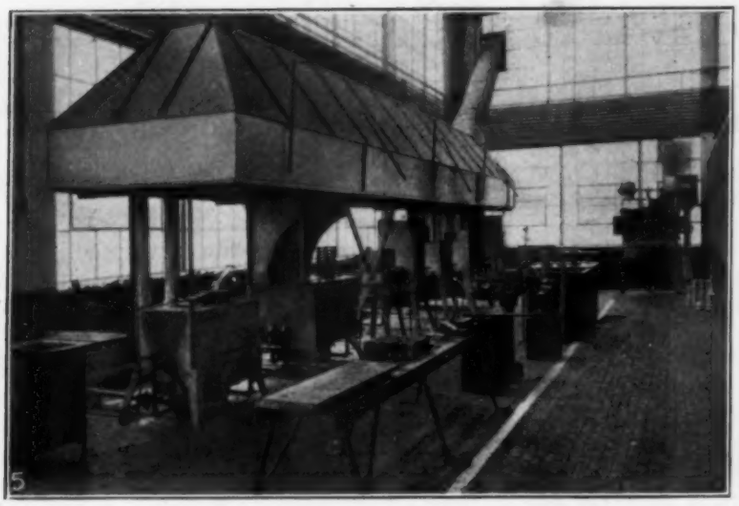


FIG. 5. THE HEAT-TREATING EQUIPMENT. FIG. 6. UNIT ASSEMBLY FOR HEAVY DUTY DRILLS

large window can be seen at *A*, at the far end of the room, while beyond them is the hood over the furnaces in the heat-treating department.

as one for heating crucibles of lead or some of the various salts. Suitable quenching tanks are also provided and a sandblast machine may be seen at the further

FIG. 7. TESTING DRILLING MACHINE BEFORE SHIPMENT. FIG. 8. FINAL ASSEMBLY OF HEAVY-DUTY DRILLS

Details of the heat-treating department can be seen in Fig. 5, all necessary equipment being generously provided. Furnaces of various kinds form part of the equipment, including both open and muffle types as well

right-hand corner. The fumes from the furnaces are caught in the large hood and carried off by the pipe shown at the further end.

One of the assembling departments, used for build-

FIG. 9. ASSEMBLING LARGE BORING MILLS. FIG. 10. TOOLCRIB, WASHROOM AND LAVATORY

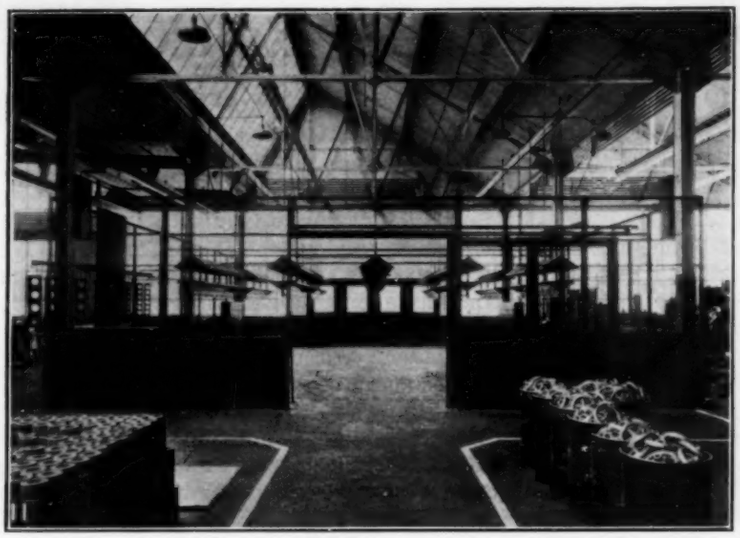


FIG. 11. AN OPEN METHOD OF CLOTHING STORAGE. FIG. 12. THE FOREMAN'S DESK

ing units of Colburn heavy duty drilling machines, is shown in Fig. 6. This view also shows the types of stands and work benches used in this department. It will be noted that the round column pedestal is used both singly and in pairs.

The method of testing completed machines is shown in Fig. 7. Each column of the testing bay is provided with suitable electrical connections and motors are located so as to be conveniently used in making the running tests.

The Final Assembly

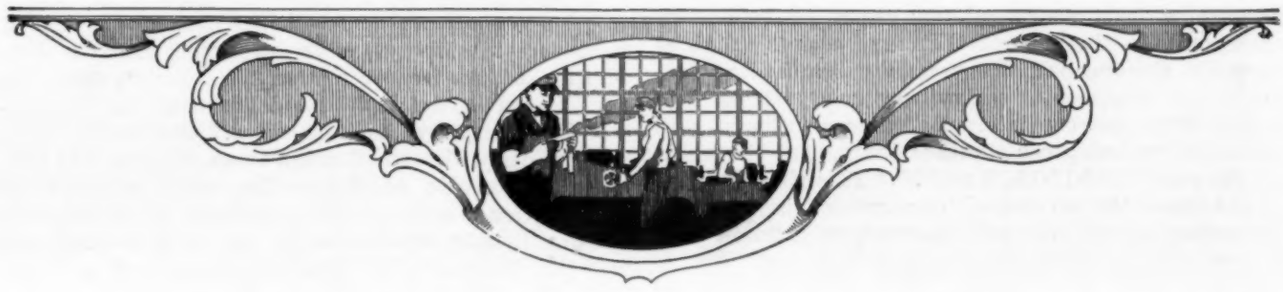
The final assembly department is shown in Fig. 8. The test columns shown are used for testing both manufacturing and standard type drilling machine heads. Each head is finished at the end of the line of benches and then carried by crane to a test column. It is then removed from the test column and placed on the column upon which it will be shipped. Bar stock racks are used for holding long screws and other parts which are liable to damage unless properly protected in some way.

The assembling department for the boring mills and heavy drilling machines is shown in Fig. 9. This, it will be seen, is one of the head houses and is served by a 15-ton crane with a 5-ton auxiliary hoist. In spite of the fireproof construction sprinkler heads are provided so as to reduce the fire risk to a minimum. A complete boring mill is shown being delivered to the shipping platform through the open doors at the end of this bay.

Fig. 10 shows the washroom, lavatory and the central tool storage crib. Little comment is necessary but a careful study of the substantial and attractive arrangement is worth while. The large windows of translucent glass in the lavatory, light it up perfectly and the compactness of the plumbing cannot fail to appeal to all engineers. The toolcrib is particularly well arranged and easily accessible.

A view of the coatroom, at one end of the shop, is shown in Fig. 11. The finishings are somewhat unusual in that open racks with suitable hooks and ample provision for hats are provided in place of the steel lockers which have been so common for the past few years. The angle of the top over the hat shelf effectually prevents the accumulation of bundles of any kind. This arrangement gives an open view of the coatroom at all times and as the door is kept locked, except at the proper hours for coming to, and going from, work, it is believed that it may prove more advantageous than the usual lockers. A few lockers for special purposes are provided in the corners, as can be seen. This view also shows more of the steel barrels used in handling castings and forgings.

Each department foreman has a substantial steel desk and stool as shown in Fig. 12. He is provided with a time stamp and a card rack for each man in his department, as well as an automatic interior telephone communicating to all parts of the plant, including the office. This arrangement is very neat, giving the foreman ample space for keeping all necessary records and other information. The facilities are such that the foreman has an incentive to produce better work and takes pride in the development of his department. There are many points in connection with these various views which will well repay a careful study. Better yet, the plant itself should be visited if it is at all possible to do so.



Bigger Business Will Need Better Railroads

Lack of Equipment Will Hold up Business Resumption — the Government Should Aid Railroads Before Helping Foreign Nations

By HERBERT HOOVER
Secretary of Commerce

IN RESPONDING to the invitation to discuss some of the problems present in your general railroad investigation, I shall devote myself to three of the railway topics which especially arise from the present economic situation.

I do not need to review at length that we are recovering from the destruction and inflation of the greatest war in history; that we are suffering from the waste, the extravagance, and over-expansion of the post-war boom; and that the war has brought about great shifts in the movement and price levels of commodities between nations.

I would, however, suggest that it might be profitable for our people to get a somewhat clearer perspective of our own, and the world's, troubles and problems. Even a superficial survey must bring us out of an atmosphere of gloomy introspection into an assuring realization that, great as our dislocations may seem to be, we relatively are in an enviable position. Our nation is unshaken and as a people we are getting our bearings in a world of perplexing economic adjustments. While there is unemployment and lack of profit taking, we are free of panic. We are comparatively more restless than injured. For instance as heavy as our tax burden is it is still less than one-half as great in proportion to our national productivity as the other states in the war.

The violence of our readjustment, however, is without parallel and we sometimes tend to color our measures for the future by the depression we are in. The fact is that we must predicate all plans for the future on the ultimate return of the American people to a normal economic activity, with our annual progress in the expansion of our production, of our plant and equipment, of our skill and our efficiency. There can be no question that this return will take place, and no responsible body will approach our problems on any other basis.

If we look at the national economic situation as a whole, the greatest impulse that can be given to recovery from any source whatever is a reduction of rates on primary commodities combined with the immediate resumption of railway construction and equipment. The first depends upon reduction of operating costs; the second upon restoration of credit for our railways.

The Need for More Railroads

One thing is absolute. Our transportation facilities are below the needs of our country, and unless we have a quick resumption of construction, the whole community—agricultural, commercial, and industrial—will be gasping from a strangulation caused by insufficient transportation the moment that our business activities resume. For the past five years we have had no consequential expansion to our railway transportation machine. With but one interval of nine months in 1918 and 1919 we had a car shortage throughout the whole of the years 1916-17-18-19 and 20. This shortage rose to as high as 160,000 cars with a corresponding shortage of motive power. We paid tremendous sums in commercial losses and unemployment in consequence. We laid it onto the war. We should lay it onto our lack of foresight and antagonism to railroads.

Our country is more dependent upon railway transport than any other. All others have comparatively greater coast lines and internal waterways. The experience of the twenty years before the war has shown that we must build an extension of lines, including terminal facilities, additional sidings, etc., every year equal to the construction of a new railway from New York to San Francisco. We must add at least 120,000 cars and 2,500 locomotives annually to our equipment. Since we entered the war in 1917 we have constructed at least 10,000 miles of railways less than our increasing population and economic development called for, and we are behind in rolling stock by about 4,000 locomotives and 200,000 cars. I wish to emphasize that unless we can have an immediate resumption of construction and equipment, our commercial community will pay treble the cost of the whole of them in their losses of a single season. The very moment that we reach anything like normal business we shall see a repetition of car shortages, followed by an increase in the cost of coal to the consumer from one to three dollars a ton; we shall again see premiums of twenty cents a bushel for the use of cars for moving grain; we shall in fact see a shortage of commodities to the consumer; and we shall see gluts upon the hands of the producers. We shall see factories filled with orders again closed for lack of cars; we shall see large intermittency in employment; and we shall see the usual profiteering in commodities due to a stricture between the producer and consumer.

Furthermore, there is nothing that is so irrecoverable a loss to the nation as idle shops and idle men. Today we have both. There is nothing that will so quickly start the springs of business and employment as an immediate resumption of construction and equipment of the railways. When business does resume, we shall need all of our capacity for the production of consumable goods. We shall not only find it strangled for lack of transportation, but we shall find ourselves plunging into the manufacture of this very railway equipment and construction in competition with consumable goods for materials and labor. Herein lies the basic cause of destructive price inflation and booms, with all their waste and over-expansion. In times of depression, we should prepare for the future and by doing so we can cure the depression itself.

If we examine the fundamental reasons for failure to resume equipment, we will find them in the loss of confidence in railways as an investment and the competition of tax-free securities. We have passed the period of credit strain in this depression. Surplus capital is pouring by hundreds of millions monthly into tax-free securities and foreign loans, and yet our railways are unable to finance the most moderate of construction programs. The confidence of the public in railway investments was at so low an ebb before the war that finance, by the issue of common and preferred

Statement before the Interstate Commerce Commission.

stocks, had become impossible and railway expansion was living on bond issues. The confidence of an assurance and continuity in earning power to cover this burden of bonds has been even lowered since the war began, because of the uncertainties of both rising and falling prices, of rising and falling wages, of rising and falling rates preventing all regularity of earnings upon which an investor could be convinced, even if no other difficult factors entered into the problem.

If we look to the immediate future with its complete necessity of paring the railway earnings down to little more than bond interest, until we give relief to the shipper (and thus the primary foundation to business recovery) I can see little likelihood of convincing the investor as to his margins of safety. There is an atmosphere that our railways will never again earn profits, and that they are not as an industry worthy of investment, and that because private investors will not come to their assistance nobody can do anything.

Far from its being impossible for our railways again to return to a profitable footing, I believe it is possible to demonstrate that on an average they will become very profitable. If we assume that the reduction of prices and wage levels will settle at a plane no lower than 50 per cent over pre-war, and if we assume that the present rates are to maintain, and if we assume restored traffic, then the earnings of our railways would exceed 15 per cent on the whole of the commission's tentative valuation.

In these circumstances it seems to me vital that the railways, as our greatest industry, should propose a courageous program of broad visioned betterments, and if necessary the Government should consider giving the use of its superior credit. It would not cost the taxpayer a cent to give the Government guarantee to equipment trusts upon the primary responsibility of the railways the proceeds devoted entirely to improvement and equipment. This is no proposal to take money from the taxpayer. It is a proposal to save him from paying treble the amount of his guarantee in profiteering and losses. It will render a reduction of rates earlier, for unless something is done the improvements will have to be paid over years out of increased rates.

A real program of construction would in its various ramifications give relief to five or six hundred thousand of our unemployed. It would enable even added numbers to increase their standard of living, and thus give increased market to the produce of our farmers. Our farmers who look to foreign markets for their surplus should stop to consider that our home consumption of meat decreased nearly 7 pounds per capita in 1921, due mostly to unemployment, and that if this decrease could be overcome it would be worth more than a 35 per cent increase in exports.

Help the Railroads First

We talk glibly of giving billions of credits to foreign countries, to increase our farm exports. I wish to say with all responsibility for the statement, that a billion dollars spent upon American railways will give more employment to our people, more advance to our industry, more assistance to our farmers, than twice that sum expended outside the frontiers of the United States—and there will be greater security for the investor.

Finally I want to refer to the veritable witch's cauldron being fed constantly with hates distilled from the misdeeds of railway promoters in the past, from the conflicts between the railways and the farmers, between the railways and their workmen. From all the confusion that arises from it we destroy our railways and destroy ourselves. With this commission on one hand assuring honesty in finance, justice to the shipper and the railways investor; with the Railway Labor Board assuring justice to workers and, above all, with a great spirit of public service in our generation of railway managers, it is time to call off the witches and take some vision of our national situation if we are to pull ourselves out of this depression.

Before entering upon the question of readjustment of rates, I wish to set out some factors in the present economic situation that bear upon the entire question. The following table shows a few commodities and service groups, compared to 1913 as 100:

Farm crops, at the farm	98
All animals, at the farm	92
Retail foodstuffs	150
Cotton, at the farm	136
Wool, at the farm	101
Retail clothing	213
Steel billets, Pittsburgh	113
Copper	86
Zinc	90
Pig iron, Pittsburgh	128
Bituminous coal, at the mine (estimated 4 districts)	160
Bituminous coal (retail various localities)	198–220
Yellow pine lumber (at the mill)	189
Douglas fir lumber (at the mill)	125
Lumber (retail), partly estimated	200
Cost of living, variously estimated from	162–180
Wage scales (approximate):	
Farm labor	135
Textile industries	210
Steel industries	150
Railways	200
Metal trades	218
Building trades	190
Coal mining scales	173

This table at once demonstrates:

(1) The inequality in prices and wages between different groups of commodities.

(2) The great increase in spread between "producer's" and "consumer's" goods.

(3) The lag in wage scales.

As the population engaged in the "deflated" producer's goods—agriculture, and metals, wood, etc.—comprises one-half the total in number of the nation, their power to buy the same ratio of consumer's goods has been reduced to less than 70 per cent of pre-war, and is the consequent cause of a large part of the industrial and commercial unemployment and stagnation in our cities and our transportation.

I wish to especially call your attention to the indicated enormous increase in spread between primary producer's and ultimate consumer's goods. In considering it, we must bear in mind that when we use 100 for both consumer's and producer's goods of 1913, we have already included the spread between producer and consumer at that period. I therefore believe that the index numbers indicate an increase of 100 per cent in the actual spread. It is right here where the most of our economic difficulties lie today. Our increased cost of manufacture and distribution bears two relations to the rate question—first, that the increase of rates of from 30 to 700 per cent in different commodities are part of it, and are in turn partly caused by it; and second, the increased rates bear very unequally on different groups in the community.

If we search for the cause of this increase of spread we shall find therein a vast complex of increased taxation, increased wages, rents, and a dozen items, all reacting upon each other, and also expressing themselves in increased cost of operating the railways. For instance, the total increase in national, state and municipal taxes since 1913 is approximately $5,640,000,000. At the present purchasing power of the dollar, our total

national productivity is probably somewhere around fifty billions of dollars, of which over 10 per cent must now be devoted to increased taxes. This sum of money must be obtained either from the producer or the consumer and in any event a considerable part of the taxes contribute to widen the spread. Because the increase in spread due to taxes necessitates a spiral of increased wages, rents, etc., and before its force expends itself, my own opinion is that possibly 20 points in the distorted index number flows from increased taxes.

The increase of railway rates since 1913 in Class I, railways 1921, is about $2,600,000,000, of which about $1,400,000,000 are due to wage increases and about $160,000,000 to tax increases. If our traffics were normal the total increase of rates would be more like $3,500,000,000. These sums enter into this increase in the spread and carry with them a further trail of increased living costs and again a spiral of higher wages, rents, etc., in all other branches of manufacture and distribution.

I wish to digress for just a moment from railway to agricultural subjects, to point out that the recent projects for fixing farm prices by law are apparently founded on the notion that by raising agricultural prices up to the levels of consumer's goods we can remedy the extreme hardship of our farmers. Even if it be possible to raise the prices, much less advantage would accrue to the farmer than anticipated. Unless the spread is decreased by actual savings, the costs of manufacture and distribution would be at least partially increased by higher prices of producer's goods. The spread is fundamentally due to increased cost of manufacture and distribution, not to the fall in producer's goods. The real remedy is an attack upon the causes of the spread and thereby to bring consumer's goods down to the producer's buying power.

It is a certainty that in order to decrease the spread, railway rates must come down and for rates to come down costs of railway operation in wages and prices of supplies must be reduced. Until this adjustment is secured the economic machine will continue to move slowly. We cannot and should not expect wages to come back to pre-war levels. Many of our wage scales were too low in pre-war times. They can follow down step by step with the cost of living, but there are permanent charges in this spread, such as the taxes, which will hold the cost of living above pre-war levels.

Method of Readjusting Rates

The involved complex of transportation rates was obviously originally based on some relationship to the value of commodities, mitigated by competition. In other words, the old slogan of "what the traffic will bear" had some economic background. But this entire conception of ratemaking was destroyed by horizontal raises. We have rates clearly beyond what the traffic can bear.

The increases in railway rates during the past five years have fallen with extraordinary inequality on different commodities and different groups of people in the community. The country grew up, its industries were distributed under ratios of costs between different commodities, ratios between raw materials and finished goods, ratios between the farm and city. These have all been distorted by the horizontal rises. The increases in rates since 1914, for instance, have added probably less than 1 per cent to the price of cotton goods on the average haul but it has added probably 60 per cent to the price of coal. The increased rates since 1914 have added nearly 100 per cent to the cost of assembling the materials for pig iron.

All this is artificially forcing our industries to move toward their raw materials. This does not alone represent the starting of a new factory; it is a movement of the whole mechanism of the community, labor, homes, schools, railways and whatnot—an enormous duplication of plant and loss of capital. We will ultimately have the rates readjusted and then we will destroy the new industries created under it.

Of equal importance there is a new economic light on this distortion of rates evident under the stress of the last few years. That is, the better realization that some increases of rates come mostly off the producer while others are paid by the consumer. Increases in spread between producer and consumer do not fall equally upon each of them. In primary commodities where the price is fixed by international competition, the increase or decrease in rates is a deduction from the producer. Take wheat, for instance, the point of competition with foreign produce lies at Liverpool. The net to the producer is Liverpool less transportation and other handling charges. Therefore increases of rates are a deduction from the farmers' price. The same thing applies to the producer in certain cases of domestic competition. Also where there is rapid turnover, as in manufacture, and consequent ability to reduce supply, the consumer pays the freight, as processes of productivity will not continue below profit point. In most manufactured commodities the consumer pays the freight, for production quickly shrinks when prices at the factory become unprofitable and the price to the buyer is the factory price plus the freight. For instance, in hides, the farmer gets the international price less freight. On boots he pays the manufacturer's cost, profit and freight.

It appears to me that with the paralysis induced by the increased spread, we have to take a broader vision of what part of the community is suffering most and direct such concessions through the railway rates as can be given to that group—if we would better equalize the whole economic lead.

During the past eight months, the railways have made many thousand readjustments of local rates in endeavoring to heal local distortions, but I am convinced that the whole railway rate structure needs a most systematic overhaul in the light of these new economic forces that have been brought into play. We obviously must maintain the average rate that will support our transportation systems adequately and such an overhauling of rates might quite well mean the advancement of rates in certain commodities in order that compensation can be given to others where there is undue duress.

If I were to discuss the rates charged today I should say at once that a decrease in passenger rates is not nearly so vital to the community as freight rates, for passenger rates do not enter into the spread in proportion to the relative volume of earnings. If I were examining the freight rates I should at once say that coal, metals, wood and agricultural and other producers goods should be reduced to the bottom before L. C. L. and class rates are touched.

I would be willing to go even farther and say that I am convinced that even if the commission cannot at the present moment justifiably reduce railway incomes a single dollar, it is warranted in investigating the pos-

sibility of some relief to the more distressed commodities by a revision of some rates upward.

Determination of anything in the nature of permanent rate basis is in my own view impossible at the present time because the last five years of changing administration, irregular traffic and wildly fluctuating wages and prices of materials give us but little reliable historical criteria upon which to base the future. We are in the midst of violent economic readjustment of a profound industrial depression. No one can determine to what plane the reduction in operating costs will settle. No one can estimate the volume of traffics that are probable for any particular period ahead. It appears to me, therefore, that the commission will need to temporize with the situation for some time, and that its conclusions may well fall into three periods: (1) The immediate present; (2) during the early period of decreasing costs and increasing efficiency and slowly recovering traffics; (3) normal operations.

If we survey the results of the past year in the application of present costs and rates, we find many railways failing to earn interest upon their borrowed capital; we find some others more fortunately situated who have earned dividends on their share capital. One or two exceptions of low bonded indebtedness have done extraordinarily well on their share capital. If we survey the situation by districts, in order that single instances do not mislead us, we will find that the whole of the Class 1 Southern roads barely covered bond interest, while the most fortunate group, the Western roads, shows an earning of only 4 per cent in 1921 upon the tentative valuation. Moreover, it is obvious that maintenance has been held to a low level and new equipment and extensions practically nil.

I believe there are cases where earnings could be increased by lower rates. I know that it is contended that such opportunities do not exist, but no one can review the testimony given here during the past few weeks without concluding that the rates in special instances are stifling business.

The Second Period: During 1922

We must assume that those railway wages and supplies which are out of line will at least in part follow down to the levels of decreased cost of living; we must assume that the efficiency that is slowly emerging after the government management will still further increase; we must assume that the volume of traffics will increase toward normal.

I have the feeling that the railways, being our greatest business, will agree that all these savings should be instantly devoted to relief in the rates on primary commodities, in order that we should expedite the recovery that can only come through decreased spread between producer's and consumer's goods.

I recognize that the uncertainty and slow reduction of rates in this fashion will itself delay business recovery because of the uncertainty of business as to its future costs. If our railways were in position to stand the temporary shock it would be infinitely better to drop the rates on primary commodities tomorrow—our business recovery would come faster. But we cannot ask the impossible.

If we look further to normal times, we could make a rough calculation that present wages and costs, at say 50 per cent above pre-war, would show that the railways can earn somewhere around a billion five hundred million dollars, in excess of the 6 per cent minimum upon tentative valuation. As I have stated, relief is first more critically needed in the rates on primary commodities. Some estimates given to me indicate that approximately 35 or 40 per cent of revenues are involved in the groups more urgently needing relief.

Efficiency of Railways

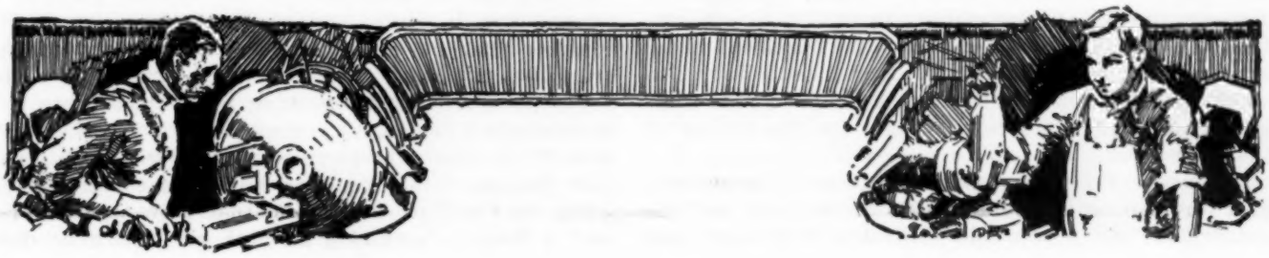
A great deal has been said about the inefficiency of our railway system. I do not sympathize with these statements. Comparison with foreign railways of the fundamental criteria of per-ton-mile costs, train loading and so forth, in the light of our cost of living, will demonstrate that our railways are of higher standards, better in methods than others and are growing in efficiency.

The consolidation of our railways into larger systems has been contemplated in our legislatures for some years past as a gain in efficiency. Its value can be overestimated—it is not a panacea for all trouble. It does give hope, however, of economies in further efficiency from more complete utilization of rolling stocks and terminals, some small degree of saving in overhead and saving in current inventories. But its greatest saving would probably be decreased cost of proper finance, increased financial stability and fuller independence from the supply companies.

It is probably unnecessary to refer to the question of government ownership. No one with a week's observation of government railways abroad, or with government operation of industry in the United States, will contend that our railways could ever be operated as intelligently or as efficiently by the Government as through the initiative of private individuals. Moreover, the welfare of its multitude of workers will be far worse under government operation.

We are struggling with the great problem of maintaining public control of monopoly, at the same time maintaining the initiative of private enterprise. I believe that we are steadily progressing to solution.

Great social and economic problems find their solution slowly and by a process of trial and error. We have tried unregulated monopoly, and have tried government operation, and found the error in them. We still have much to solve if we are to maintain our transportation. Much of this solution depends upon the successful initiative of the railways themselves and much of the shaping of these matters lies, fortunately, in your able hands.



Attributes of a Successful Foreman

The Opportunity of Foremanship—Great Advantage of a Cool Head—"Bossism" vs. Leadership—Method of Rating the Men—Planning the Work

By JOHN S. WATTS

THE position of foreman is the logical stepping stone from the ranks to a ranking and should be aspired to by the young mechanic as soon as he feels confident of his ability to handle any work that is part of his trade. It is not essential, nor is it hardly possible, that the aspirant for a foremanship should be an expert in every operation that is to be performed in his shop, but it is most desirable that he should be able to perform every operation, even though he may not be able to do it as quickly or as well as the expert. At the very least he must know how the work should be done, and this is best learned by having executed the work itself. While it is true that many successful foremen have been made out of men who could not themselves perform all of the operations that are being done by the men under them, this lack on the part of the foreman is always discovered by the men, and constitutes a serious disability to him, which has to be overcome by extra ability in other directions.

In nearly all cases the promotion to a foremanship comes without previous training for the office, and unfortunately it is very seldom that such training is possible. The position is made still harder by the fact that the man who tackles his first job as foreman is in a position where he can be, and is, easily compared with his predecessors, and should he fail to measure up to the standard set in the mind of his superior, he is rarely ever given the chance to rectify his mistakes although his failure may be due simply to a lack of experience. In the latter case, on a longer trial he might prove highly successful.

The Critical Time

On this account, the first month or so in the position of foreman is the most trying time of any man's career, calling as it does for the exercise of faculties which have previously been undeveloped, and as it is impossible for his wellwishers to do much in the way of assistance, he is in a most vulnerable position for the attacks of his enemies.

The opportunity is likely to come to any good mechanic at the most unexpected time, and if he fails to be prepared it is unlikely that the chance will come again. It therefore behooves the ambitious man to be prepared as far as possible, and not to rest content with thinking that a high grade of mechanical skill will be sufficient to carry him through. He should at least study the methods of the foremen with whom he comes in contact; much can be learned from both good and bad foremen by comparing the difference in their methods, and the results obtained by each. Having been through the mill myself from apprentice to superintendent, I have had experience with foremen of all kinds, good, bad and indifferent; therefore, I propose to touch upon the qualities that are common to good foremen, and also the principal reasons for the failure of the poor ones.

The first and most necessary requisite of the aspirant to a foremanship is the ability to control his emotions absolutely. He who would control others must first of all be master of his own mind, and must have exercised this control over himself long enough for it to have become a habit and not a conscious effort.

There will be many times when a foreman will be tempted to give way to anger, such as when by some stupid mistake a man spoils a piece of urgently-wanted work. To waste time in blasphemy or swearing at the culprit only results in still further delay and also in an exhibition of weakness. The real foreman will remain calm, and thus his brain will be in condition to quickly evolve a way of remedying the mistake and to issue the necessary orders. The habit of swearing is one that should be avoided, even if indulged in only under extreme provocation, as it is apt to increase the tendency to lose control of oneself through anger. Indeed, the use of any unnecessary words in conversation or in issuing orders is a waste of time, and any tendency to loquacity in speaking or even in writing should be sternly repressed.

The Value of Conciseness

One foreman I knew who was otherwise a fairly good man, was finally asked to resign for the sole reason that the simplest question put to him would involve one in an extended conversation covering perhaps fifteen minutes, when as many seconds should have sufficed. Not that he wandered from the subject in question, but that he could not give a direct and concise answer to the question; he must cover the whole subject, bringing in matters irrelevant to the point under discussion until in shear weariness one often left him talking in the middle of a sentence and obtained the information wanted by some other means.

A common failing with all humanity is the dislike for meting out punishment for stupidity or wrong doing except when in anger. This failing should be conquered as it leads to injustice, making for the imposition of a heavy penalty for a trifling offense done when the foreman happens to be in a bad humor, or the complete disregard of a serious offense if the foreman happens to be in a happy frame of mind. Any foreman who allows his emotions to control him to this extent soon loses the confidence of his men, and will be accused of favoritism of which he may be quite innocent.

On the other hand, by keeping always in a calm state of mind he is able to supervise the work with even-handed justice to all, his men will gain confidence in his fairness, he will find it easy to keep discipline, and his men will work for him to the best of their ability.

The foreman should regard himself as the leader of his men, not as their boss or driver, nor even as a commander; in giving out work to a man, he should consider that he is issuing instructions, not giving orders or commands. It is folly for a foreman to adopt a tone of command in speaking to his men; they are not compelled to obey his commands, although they may do so for a time in preference to quitting the job. The wise foreman will remember that the men can choose whom they will work for, and that they naturally resent a foreman assuming an authority which he does

not actually possess. The bullying type of foreman will be compelled to use a more moderate tone toward the more skilled men in order to retain them, and as this cannot fail to be observed by the other men, it will result in the loss of any respect they may have had for their foreman.

The fact that a foreman's success depends very largely upon the way his men work for him should never be lost sight of by the beginner. He will learn this if he holds the position long, as the fact will be impressed upon him so thoroughly that he will never overlook it. Experience has proved that the "leader" type of foreman will always get a higher production and a much better quality of work than will the domineering type.

All foremen, and especially new ones, are in a position that lays them open to easy criticism, so until their success is proved they should be wary of their steps. There are always many jealous people ready to spread the story of any little mistakes they may make, even though it may be of no importance. The foreman should not be afraid to criticize a man's method of handling his job, but he should be sure of his ground even to the point of delaying action until sure of his position.

A little instance will explain the point; I was given a planer job to do in a small shop where each man had the run of the shop, so far as using any particular machine was concerned. The job was obviously one for the small planer, but being unable to find the size of bolts needed at the small planer I went over to the large planer and started it up, as the table covered the place where the clamp bolts were kept. Just as I got the large planer started, the foreman, who was new on the job, came along and rather abruptly told me to put the job on the small planer. I of course explained that I was simply borrowing some bolts from the larger planer, which had he held his peace for half a minute he would have seen. Unfortunately for him quite a number of the men heard him and the snickers that he heard made the rest of that day rather uncomfortable for him.

Nevertheless, if one is sure that a job is being handled wrongly one should not be afraid to say so. The operator should be told just why his way is wrong, and the foreman should be sure that he is convinced before leaving him. Considerable tact is required in these cases, as some men are very obstinate about admitting their mistakes and some will harbor resentment, feeling that they have been shown up before their fellows.

If for any reason a man is unsatisfactory and has to be discharged, a foreman must have a really good reason for discharging him. It must also be one that can be demonstrated satisfactorily, as it is in the exercise of this function that the foreman is most open to criticism of favoritism or wrong doing, and the sympathy of his critics and even of his friends will naturally be with the discharged man unless the foreman has an obviously good reason for the dismissal.

In most shops the foreman has the onus of rating the men's pay in accordance with their value to the company, and in the smaller shops especially, this duty is one that is difficult of performance with satisfaction and justice to all. Here the foreman is between two fires; on the one hand he has his superiors whom he has to convince of the necessity of granting increases to certain of the men, and on the other hand, the men look for increased wages as their skill increases, with the result that in trying to satisfy both parties, he is subject to criticism from both sides.

Frequently the man who is applying for an increase will cite the rate of some other man as being higher than the applicant's in proportion to his skill. As the applicant naturally chooses for comparison that man whose rate gives him the best case for an increase, the process soon becomes endless unless great care is taken in setting all the rates. The granting of one increase will bring in its train demands from another whose rate is low when compared with the one just increased, and so on *ad infinitum*.

As quickly as possible after assuming charge of a shop, the manufacturer should make up a list of all his men, rating them by percentages of efficiency according to output, versatility, dependency, etc., and as he comes to know each man's capabilities better this list can be revised until he has a fairly just rating of all the men. Then if their rates are adjusted by judicious increases according to this rating, it should be possible to prove either to the applicant for an increase that he is receiving a wage in proportion to his skill as compared to the other men, or else to show the manager that the applicant is deserving of an increase.

In distributing the work among the men, much time can be wasted by not being ready to assign another job to a man the moment he completes the one in hand. The foreman should have a list of all the men employed, and keep on this list one job ahead for each man. Indeed, if possible, it is better to have every job in sight assigned to somebody. This will insure always having work ready for each man, and the material, tools, etc., for the next job can be ready at the machine before the man has completed the previous job, thus preventing the waste of time between jobs so common where the foreman has no systematic ability. This list should be made out carefully, so that if the foreman is called out of the shop for any length of time, or is absent through sickness, an assistant can keep the shop running temporarily.

Finally, the man who gets a foreman's job must learn to disregard the whistle. This may come a little hard at first, after years of dropping all thoughts of work the instant the buzzer blows, but no foreman ever succeeded who started and stopped by the time-clock. During the normal working hours, the demands on a foreman's time for instructions, supervision and consultation are so pressing that he will have scant time for that "planning ahead" of his work which is so essential to success. This planning will take up some of what have been his leisure hours, but if he is worth his salt the satisfaction of successful administration will more than compensate for the loss of other more or less inane amusements.

This may read as a rather discouraging and formidable array of virtues to be achieved by him who would attain success as a foreman, but the goal is one well worth striving for. Bear in mind that for the mechanic practically the only road to a higher position is through a foremanship, and that this position once gained and successfully held opens up a vista of greater possibilities, the first step being the most difficult of accomplishment.

Indeed, the cultivation of the necessary qualities of self-control and the ability to handle men are of themselves a sufficient reward in the increased confidence and happiness which they bring to their possessor, even without other gain, but the possessors of these virtues are so few that one who has them will not be long without some chance for promotion.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Collet Chucks for Holding Delicate Parts

By Milton Wright

In the making of knitting machines there are many delicate parts like that shown leaning against the toolpost of the lathe in Fig. 1. These parts are often,

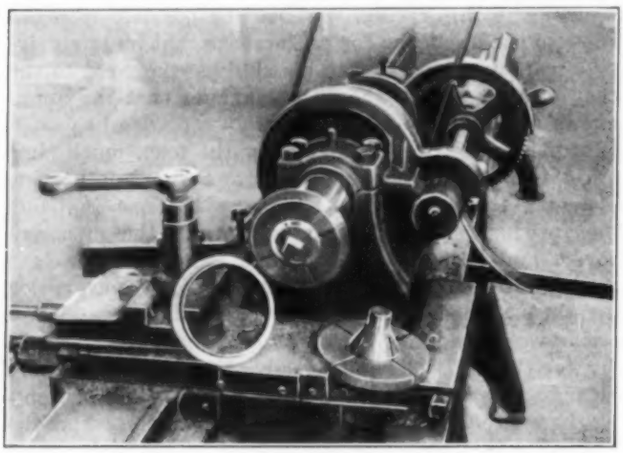


FIG. 1. INSIDE AND OUTSIDE COLLETS ON ENGINE LATHE

though not always, of brass and must be handled very circumspectly in order to avoid distorting or bruising them.

To enable the operatives to handle them quickly without danger of spoiling them, engine lathes, bench lathes, hand milling machines and gear cutters, wherever the parts are worked upon, are fitted with the interchangeable collet chucks shown.

The chucks are made for both internal and external grip. The same chuck body holds either collet and of any size, so that all the operator has to do to chuck a piece of work is to pick up the collet that

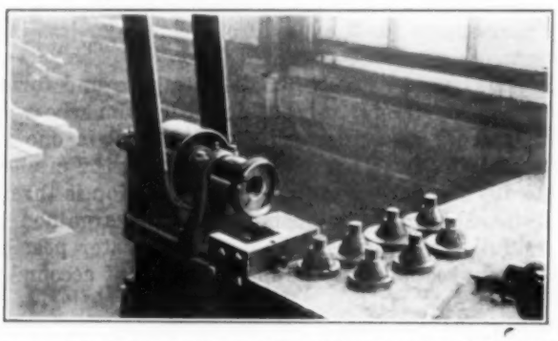


FIG. 2. COLLET CHUCKS FOR FILING AND POLISHING

fits it, spin it into the seat in the chuck body, and put in the work; less time required to do it than to write the description.

The outside collets are knurled on the periphery so that a hand grasp is all that is necessary to tighten the work, even for a turning or facing operation. The internal chuck, shown on the spindle nose in Fig. 1, is tightened by means of a wrench on the tapered drawbolt that passes through the collet into the body of the chuck.

In Fig. 2 are shown a number of the collets on the bench lathe so that filing, polishing, or hand turning may be done without the expenditure of time or energy in devising means to hold the piece.

The chuck bodies, fitted to the various machine spindles, are of steel and carefully ground to the correct taper. The collets are usually made of cast iron, and the slotting is carried only as far as the threaded portion, so there are never any loose parts to be watched.

The making of the collets is a simple and inexpensive lathe job; good practice for the apprentice boy in the tool room. If he should spoil one now and then the loss would be inconsiderable.

Chuck for Drilling Two Widely Separated Holes in Alignment

By Amos Ferber

The piece shown at *A* in the illustration is the vertical shaft bearing bracket of a Scott & Williams knitting machine. It is of cast iron, about 8 in. long, and the hole in which the shaft takes its bearings is drilled and reamed for a short distance only at each end; the central portion of the casting being cored out.

To drill the hole at one setting would require a long slender drill which, on starting the hole in the second portion, would necessarily be unsupported for a considerable part of its length and would, therefore, be quite likely to run out and destroy the accuracy of alignment.

A method of drilling from the outer ends was sought that would allow the use of short drills and at the same time preserve the alignment despite the separate setting that would be required. The chuck, shown in part at *B* and *C*, was the solution.

The chuck body screws to the spindle nose of a J. & L. turret machine and the outer end of the body is recessed to take the cradle *B*, which holds the piece to be drilled. The recess in the chuck body is larger in diameter than the cradle, and the bottom of the recess is beveled to match the beveled end of the cradle.

The knurled ring *C* is recessed in the same manner with a corresponding bevel at the bottom of the hole, and screws over the chuck body so that when assembled with the cradle in place the latter is held by end pressure alone; the bearing being only upon the beveled surfaces. The cradle is symmetrical so that it is held either way by the chuck and is accurately centered by the bevels.

The work rests in V-blocks at each end of the cradle and is secured by caps that are fastened with small

machine screws. Because of the shape of the piece it is necessary to remove the screws at each reloading. When in place, the work becomes rigidly a part of the

THE WORK AND PARTS OF THE CHUCK

cradle and the whole is handled into and out of the chuck as one piece.

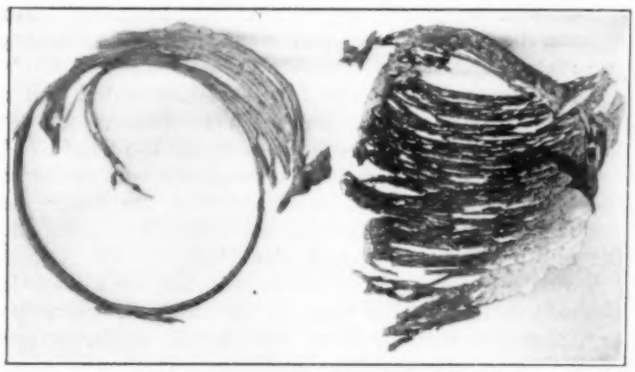
Two drilling and reaming operations are required; the hole at one end being drilled and reamed, the ring taken off and the cradle reversed without disturbing the work, and the drilling and reaming operation is repeated. As a precautionary measure a line reamer is passed clear through each piece as it is taken out of the cradle, but the reamer finds nothing more to do than to finish size the hole, as the two parts thereof are in practically perfect alignment as the work comes from the chuck.

Peculiar Chip From a Boring Tool

BY R. GRANT

The accompanying halftone shows a curious chip that came out of the end of a steel tube that we were boring. The tube was about 6½ in. in diameter, and the roughing cut, removing ⅛ in. diameter, pushed out such chips ahead of it.

The curvature of the chip was reversed; having the scale upon the outside of the curve. The tubes were carried in supports bolted to the carriage of



PECULIAR BORING CHIP

an engine lathe and the boring was done with a tool in a bar upon centers. The complete ring at the right came at the end of the cut.

How a Difficult Piece Is Hardened

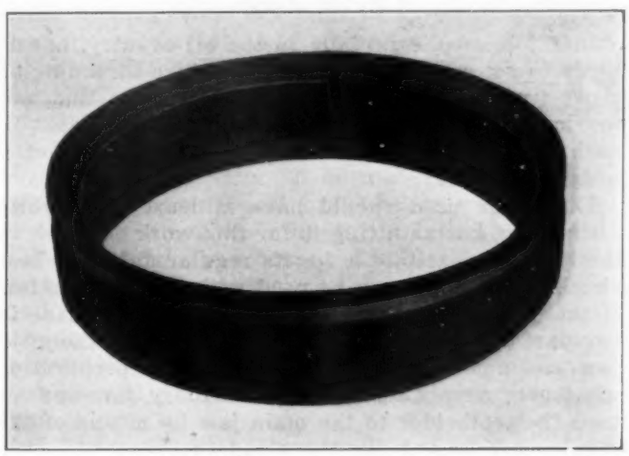
BY LEONARD H. ANDERSON

The ring shown in the illustration is 19 in. in diameter and upon its periphery are 600 narrow slots cut by a saw in an automatic gear-cutting machine. The slots are 0.035 in. wide by 0.182 in. deep. The ring is a "cylinder" for a knitting machine and the slots are the channels in which the knitting needles work.

The slots must be of uniform width and depth in order to permit the extremely rapid reciprocating movement to which the needles are subject; there must be no tight spots to interfere with the free movement of the needles, nor must there be any looseness to allow them to shake or move sidewise.

Merely to harden the ring would not be difficult; anybody with sufficient knowledge of the action of fire and water upon steel could do it. To harden it so that each one of the 600 slots shall be a perfect fit for its individual needle after hardening is a job that might well cause consternation to the hardener who is not accustomed to this class of work.

The slots are cut slightly deeper than is required to clear the needle so that the outer diameter of the ring may be ground, but since it is obviously impossible to grind the bottoms of the slots, any distortion of the ring in hardening would result in making the slots of different depths after grinding the outside; leaving some of the needles loose and binding others so that



A DIFFICULT PIECE TO HARDEN

they would not move. This consideration is what makes the hardening a difficult job.

The heating is done in a gas fired furnace fitted with two electric pyrometers for determining the heat. The work is packed in a rectangular iron box, the dimensions of which are such as to allow about 3 in. clearance at the four points where the circle of the ring approaches the straight sides of the box, and a similar clearance is allowed at top and bottom. The packing material is ground bone.

After the box is placed in the furnace, the heat is gradually raised to 1,450 deg. F., where it is allowed to remain for a period of four hours. The temperature is then permitted to fall to 1,400 deg. for a few minutes before taking the box out of the furnace.

For quenching, a cylindrical tank of oil about four feet in diameter by six feet deep is provided. A hoop, made of iron pipe and of approximately the same diameter as the ring, has four stout wires depending from

it, each ending in a hook about two feet below the hoop.

The heated ring is suspended from these hooks and a board is passed under the hoop to furnish a convenient means of carrying it. When all is ready, the ring is lowered vertically into the oil until the board rests across the edges of the tank.

The heated ring thus suspended in the middle of a large volume of oil creates a circulation of the latter which, because of the ample space surrounding the ring, is free to flow upward and thus prevent the formation of gas pockets while insuring a steady stream of comparatively cold oil to all parts.

The work is allowed to remain without movement in the quenching tank for about five minutes; the exact time having been determined by long experience. It is then transferred to a similar, but smaller, tank of heated oil for tempering. Upon removal from the tempering bath it is cleaned with sawdust and allowed to cool in air.

A distortion of more than 0.002 in. from true roundness or a crack in any one of the 600 divisions between the cuts would be sufficient cause for rejection. That very few are lost out of the large number constantly passing through the hardening room is a distinct credit to the men who handle the operation.

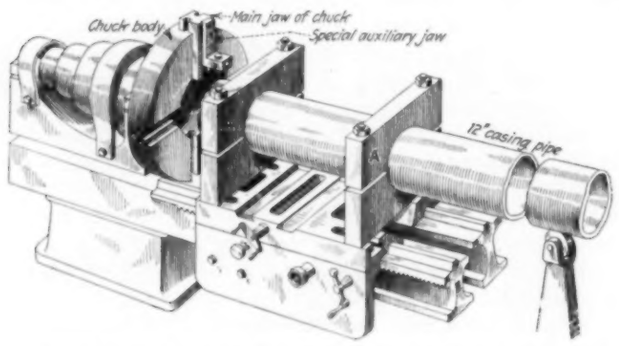
Improvised Turning, Threading or Trepanning Rig

By H. Beard

In a job shop, especially in the oil country, one is likely to get occasional jobs that require threading or short turning operations on pipes or bars that are too long for the lathe or too crooked to swing. In such cases I have found the rig shown in the sketch to be very handy.

The chuck used should have at least one tightly fitting jaw, but as fitting it for this work does not in the least incapacitate it for its regular duty, the best chuck in the shop may be used without compunction. If the chuck is of the kind that has its jaws made in two parts, the necessary holes are already in the main jaw and the chuck itself requires no preparation whatever; simply take off the auxiliary jaw and attach the toolholder to the main jaw by means of the regular screws.

The wooden clamps *A* must, of course, be made up to suit each job, but this can be done very quickly



TURNING OR THREADING THE ENDS OF LONG OR CROOKED PIPES

if a bandsaw is available, and in but little more time if the hole must be bored.

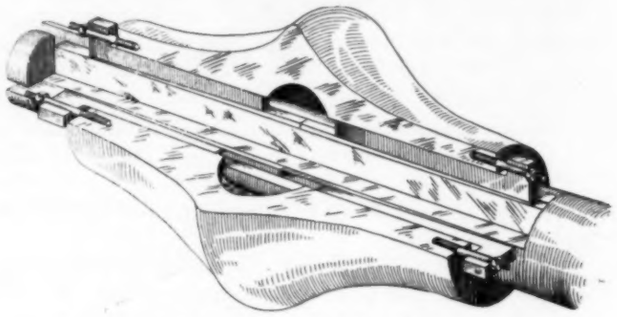
A star wheel fitted to the chuck screw, and a pin clamped to any convenient part of the lathe in such position as to engage with the points of the star wheel, will provide an automatic feed movement in case it is desired to face or undercut work such as pipe flanges, when on the pipe, or other work that must be held stationary while the tool revolves.

A chuck fitted up in this way for a lathe or drill press, and provided with a pilot for steadying the work, makes a very good adjustable trepanning tool.

Keying a Large Fan on an Engine Shaft

By F. C. Sinback

Some time ago the writer was called upon to make a repair on a large engine-driven ventilating fan used in a coal mine. The fan was mounted directly upon



KEYING A FAN HUB TO AN ENGINE SHAFT

the shaft of a single-cylinder reciprocating engine, which had no other duty than to drive the fan, and the fan itself constituted the flywheel.

As the machine was designed to be erected in the field, the hub of the fan was made a push, or light driving fit upon the shaft and was secured by a feather key let into the shaft and over which the hub must be driven. Setscrews through the hub bore upon the top of the key and were depended upon to hold the fan securely in place.

If such a design had been used upon a belt or motor-driven fan where the torque or driving impulse would be practically constant it would in all probability have proved satisfactory; but in this case the constant yank of the engine in passing over the centers soon caused the hub of the fan to work loose and become in a fair way to destroy both key and keyseats. This action was of course cumulative, growing noticeably worse from day to day as the movement increased, until it soon became evident that a repair was necessary in order to forestall a complete breakdown.

To make the repair the fan was dismounted and a portable keyseat miller was used to redress and at the same time deepen the keyway in the shaft. A second keyway of the same dimensions was made in the shaft at 90 deg. of rotation from the first. As we had undertaken the repair promptly, the keyway in the hub did not need much attention.

Two headed keys were then provided, as shown in the sketch, to take the place of the single long feather key, and thin tapered fillers were placed in the bottom of the keyway. The keys were then met and driven home, one from each side of the hub.

Two similar keys and fillers were placed in the new keyway but, as there was no corresponding keyway in the hub at this place, the outer surfaces of the keys were rounded to conform to the contour of the

bore and the keys acted only as wedges to tighten the hub on the shaft.

After the machine had been running for a day with the new keys in place the keys were again driven up solidly with sledge and drift bar; this practice was repeated each week thereafter until no more movement of the keys was perceptible. No further trouble was experienced.

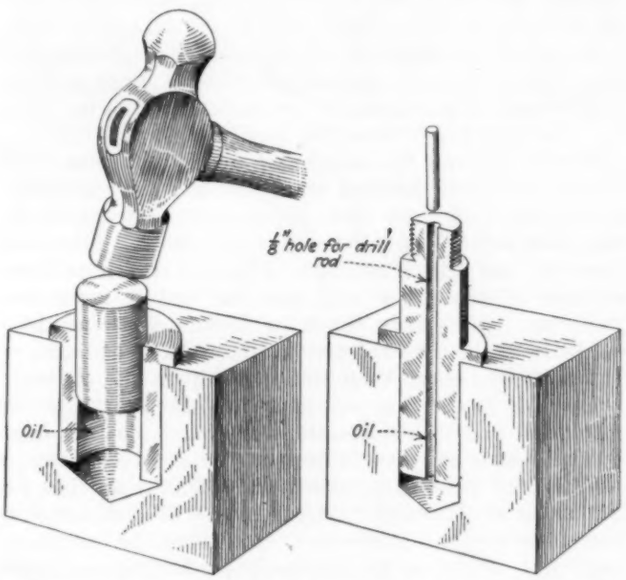
For this class of machine that is to be assembled in the field I do not believe in feather keys. Good substantial taper keys should be provided. The hub may then be slid into place easily and after the keys are driven up tightly there will be no chance for further movement.

Bushing a Blind Locating Hole

By H. P. Camp

On page 978, Vol. 55, of American Machinist there was described by Charles Reimschissel a method of removing a bushing from a blind hole, which seems to be the practical way under favorable conditions and provided, of course, the nut is not forgotten at the time the bushing is forced into the hole.

The accompanying sketches show how the bushing could have been removed if the nut were forgotten, and also how the same method is applied in case of a stud. The removal is accomplished by means of a



FORCING OUT A STUD OR BUSHING BY OIL PRESSURE

piece of drill rod or smooth round piece of steel fitting the hole freely but without shake.

The hole is first filled with oil from any convenient oil can, then the rod inserted and given a smart, quick blow with a hammer. Usually the bushing will come out with the first attempt.

The rod should not be any longer than is necessary. If too long it will be liable to spring or bow.

Stiffening a Boring Bar

By Dexter W. Allis

A boring bar will do much better work, and chatter less, if a metal wedge is forced between the back end of the bar and the toolholder.

Avoid Danger When Drilling in the Lathe

By Harry Senior

From time to time there have appeared in the columns of the American Machinist articles and letters telling the manner in which a drill or reamer should be held in the lathe when performing chucking operations, if the operator would avoid the danger of personal injury. To my old-fashioned mind, though all of these letters have pointed in the right direction, none of them have quite reached the mark.

It is the usual practice in chucking work in a lathe to place a common lathe dog on the shank of the drill or chucking reamer with the tail of the dog pointing toward the business end of the tool, and then to set the center-hole over the point of the tail center and feed the tool to the work with the screw of the tail-spindle. To prevent the tool from rotating with the work a bar of steel (usually a convenient lathe tool from the tool board) is thrust between the tail of the dog and the shank of the drill or reamer, with the free end resting upon the wing of the carriage.

Where the Danger Comes In

This, so far, is a dangerous condition. When the drill breaks through the work (a reamer is likely to "draw in" at any time) it is very likely to jump off the slight hold furnished by the center and twist out of line, thus cramping the drill in the work and fetching the lathe up "all standing." When this occurs, and its occurrence is practically inevitable, the drill or reamer will be ruined, the work will be shifted or perhaps thrown out of the chuck entirely, and there is an excellent chance that *somebody*, not necessarily the operator, will get hurt.

To prevent such a contretemps the writers of the above mentioned articles all advocate the placing of a lathe tool (reversed) in the toolpost in such position that it will bear against the dog and thus interpose the resistance of the carriage, which will be pushed along by the feeding pressure applied to the tail-spindle screw. This method removes most of the *probabilities* of accident but *none* of the dire *possibilities;* in fact it aggravates them. The operator is gambling upon the carriage to do just what he intends it to do. But it may not.

Now the right way to avoid all danger from this source was forcibly demonstrated to me about forty years ago through the medium of smashed fingers, a ruined reamer, and the good offices of a kindly-eyed, stern-voiced, gray-haired old man of the type whose scarcity we now mourn. He said: "Turn your dog around, sonny, so that the end of the tail will be about flush with the end of the reamer shank. Now set that tool in the toolpost so that it bears against the yoke of the dog as close to the shank of the reamer as you can get it, and be sure that it is so placed that the reamer, dog and all, can run with the lathe without hitting anything. Now throw that boring tool that you are using for a bar into the scrap-box and substitute a pine stick."

When I had done all these things he said further: "Now you can go ahead as fast as you want to. If anything happens the stick will break and the reamer and dog will run quietly around with the lathe. All you will have to do will be to get another stick. *Now* you have got to nurse a bunch of sore fingers for a week and I have got to buy a new reamer."

EDITORIALS

The Wave of Economy Threatens to Submerge the Department of Commerce

DISQUIETING news keeps leaking out from the committee room where hearings are taking place on the appropriations for the Department of Commerce. There is grave danger that the spirit of virtuous economy which flames high in the breast of Congress will burn out the good with the bad, and leave Mr. Hoover with his hands tied.

The Department of Commerce gets but one-half of one per cent of the total appropriation for running the country. It is about the only arm of the Federal Government that is of any service to business. The modest increases requested by the Secretary of Commerce have been approved by General Dawes, Director of the Budget, and thus receive the stamp of expert approval. This should be sufficient for any one but the politician, who looks for votes rather than for chances to improve government services to the citizen.

The politician, however, has his ear to the ground listening for the voice of his constituents. If he hears no voice raised in support of the appropriations for commerce, he is more than likely to decide that the general showing of reducing the total budget will be sufficiently popular to obscure the elimination of vital aids to business. It is not sufficient to make your own voice heard in Washington—see to it that every business man near you does likewise.

The Soldiers' Bonus and Business

THE question of the soldiers' bonus is again being forced to the front. And, as it involves the problem of raising additional revenue in enormous amounts, it interests every business man who is endeavoring to readjust his affairs on a sound basis.

It is not a question of gratitude for those who endured the hardships of war. Whether they went voluntarily or because they were forced into it by the draft does not especially matter. They went because it was their part to play. They played it well and we all honor them for it. As a matter of fact most of them couldn't have been kept out of the fight.

Thousands of the soldiers themselves are opposed to the proposed bonus. Those who require medical attention or financial assistance, or both, should receive what they need freely and generously. But no bonus can ever repay the suffering and hardships they endured. Those who do not require it should not be placed in the position of accepting gratuities.

We heartily approve of a real vocational training for all ex-service men who desire it. But the way in which this has been administered in the past is not particularly encouraging. This training can be carried out, however, so as to be highly beneficial both to the individual and to the country as a whole.

It is well to bear in mind the aftermath of the civil war as to the question of pensions. The milking of the U. S. Treasury by thousands, who never deserved pensions at all, is a well-known story which we cannot afford to repeat.

Organizations, which have the real interest of ex-service men at heart, will not urge an indiscriminate bonus to all who wore the uniform. Neither will they threaten legislators who oppose it. They can and should do much to insure proper treatment of those disabled in any way. They can and should insist on a fulfillment of the promises made regarding vocational and other training. But any attempt at a wholesale raid on the treasury will not be to the best interests of the country nor to themselves. Every business man should oppose it because it is unsound.

It's Time for Real Sales Engineering

EVERY shop manager or superintendent who is likely to be found in the running next year, is already beginning to plan for future changes in a more or less definite way. He has of course, been thinking about it for some time but there is a decided feeling that the bottom of the depression has passed and that the shop which isn't actually ready for business is likely to be left by the wayside. This feeling has reached the stage where methods are actually being planned and the wide awake shop managers are more receptive to ideas than has previously been the case.

Now is the time for missionary work to be done, both by the use of the printed word and by sales engineers, men who know not only prices but just what the machines will do—and how they will do it. Traveling expenses are still high, but railroad fares have been relieved of the 8 per cent war tax and in some few cases hotel rates have receded a trifle. But regardless of the cost, the time for missionary work is at hand.

This means more than salesmanship in the ordinary sense. It means that real engineers, familiar with the machines and their possibilities, must do thorough educational work with those who can use to advantage machines of their particular kinds. This is no time for glittering generalities. Before men will even consider replacing present equipment, they must be convinced beyond a doubt as to increased production or better work, or both.

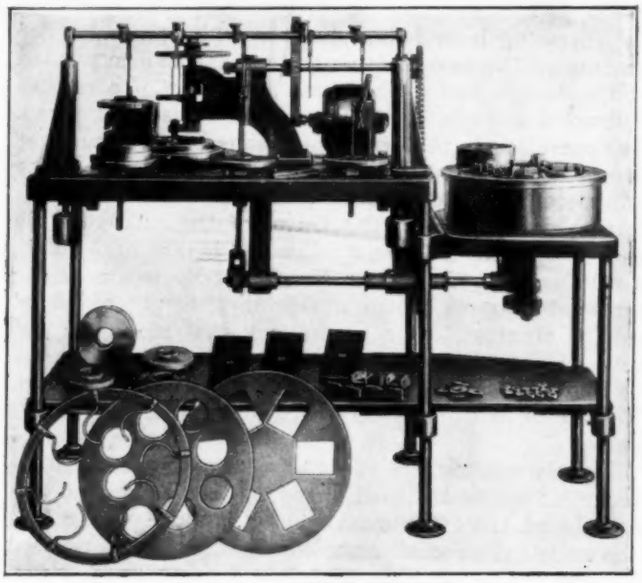
The sales engineers must in fact be production men as well. They must be able to analyze the other man's problem, show him how and why the machine tool in question is adapted for the work, and give fairly definite figures as to production and its cost. Care should be taken to stress production as the main point. Machine tools should never be sold on any other basis. The most successful factory managers do not buy so many pounds of iron and steel at so much a pound. They buy the ability to produce, or production capacity, and prices should always be considered from that standpoint.

Immediate orders are not likely to be forthcoming in many instances, although they are being placed in more cases than we are apt to realize. But missionary work at this time will bear fruit in the months to come. It's time for real sales engineering.

Shop Equipment News

Foster Air-Brake Valve Finishing Machine

The machine shown in the accompanying illustration is intended for finishing the working parts of the valves employed in railroad work for air-brake equipment. It is semi-automatic in operation, and intended to give much more rapid and more accurate lapping than that performed by hand. It has recently been placed on the market by the Walter H. Foster Co., 50 Church St., New York, N. Y. The machine enables the finishing mechanically of both slide valves and their seats, the lapping being done by the machine. It is thus possible to maintain flat surfaces to the edges of the ports and openings.



FOSTER AIR-BRAKE VALVE FINISHING MACHINE

At the right side of the machine is shown a rotating disk for lapping the parts. Plates, such as those standing in front of the machine, are used to hold the parts in position on the disk. In the illustration, several types of valves are being lapped at one time. The plates are made to accommodate both the seats and the rotaries of engineers' and of independent brake valves, the graduating valves and slides for triple valves, as well as the slides for the distributing valves. The lapping plate and the work holder rotate in opposite directions and are eccentric to each other. Consequently, the work is constantly changing its position on the lapping plates. This method of operation enables both the obtaining of flat surfaces on the parts and the keeping of the lapping plates true.

It requires from 5 to 15 min. to lap a surface, although ordinarily a number of pieces are finished at one time. The lapping plates are kept plane and in the proper condition by the rotary mechanism shown at the back of the machine on the left-hand side. Two plates are rotated against each other with the centers eccentric, so that they are ground perfectly true.

The horizontal rod shown at the top of the machine reciprocates in a vertical plane, so as to move through a distance of about 1 in. the lap sticks that it holds. This part of the apparatus is intended for finishing the seats in the body of the valve itself, and is so arranged as to hold five valves at one time. An arrangement is provided at the bottom end of each lap stick for holding it in the proper position against the work. The bars used for this are adjustable as to the pressure applied, and automatically drop down out of the way when the lap stick is removed. At one station there is a fixture for finishing the seat for the graduating valve. The mechanism at any station can be stopped and started independently of the others.

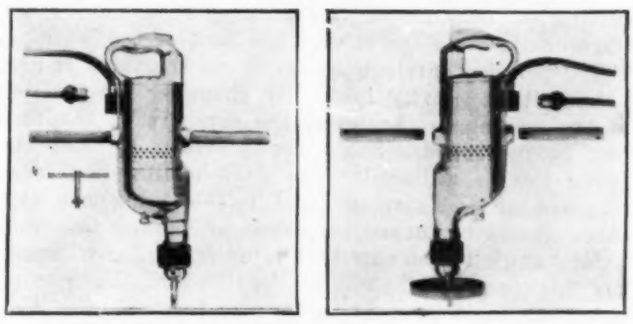
A ¼-hp. motor is ordinarily used to drive the machine, although tight and loose pulleys can be employed instead. Clutches are provided, so that one part of the mechanism can be operated while the rest remains idle, if so desired. The machine requires a floor space of 64 x 28 in. and weighs 1,200 pounds.

Wodack Combination Portable Electric Drill and Grinder

The Wodack Electric Tool Corporation, 23 South Jefferson St., Chicago, Ill., has recently placed on the market a combination portable electric drill and grinder. The tool is shown in the accompanying illustration as adapted to both drilling and grinding work. It has a drilling capacity of ⅛ to ⅜ in. in steel, and when used as a grinder it carriers a 6 x ¾-in. abrasive wheel. The device is similar in construction to that described on page 37, Vol. 54, of AMERICAN MACHINIST, except for the fact that its speed is different.

Two speeds are provided, the slow one being for drilling and the fast one for grinding. The tool can be quickly changed from high to low speed and from grinding to drilling equipment. The motor develops ½ hp. under load. Due to the fact that it is of the universal type, it can be operated on both direct and alternating current having the same voltage. The switch is located in the handle at the top, and is of the make and break, automatic-stop type. The operator must grip the handle or apply pressure to close the circuit.

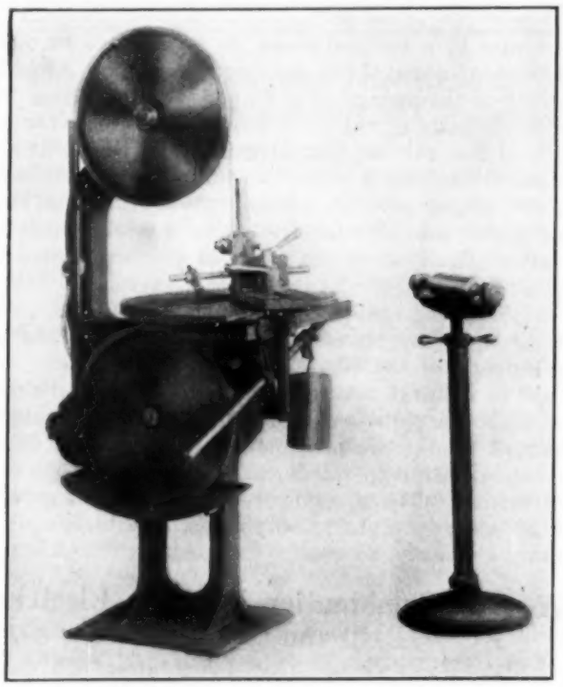
Aluminum castings and ball bearings are used throughout. The total weight is 19 lb. All parts of the tool, including the motor, are made in the Wodack factory. The device is adapted to general work.



WODACK COMBINATION DRILL AND GRINDER

Clark Metal-Cutting Band Saw

On page 969, Vol. 54, of AMERICAN MACHINIST, there appeared a description of the Clark metal-cutting band saw. The machine shown in the accompanying illustration and recently placed on the market by the Clark Tool Works, Inc., Belmont, N. Y., is very similar in construction to the machine previously described, although it is provided with such features as a movable carriage, gravity feed, work-holding vise and motor drive not incorporated in the former model.



CLARK METAL-CUTTING BAND SAW

The machine is equipped with ball bearings throughout. The upper wheel bearings are packed in grease, while the lower bearings are lubricated from the gear box. The machine is driven by means of an electric motor mounted at the back. The motor connects directly to a gear box located on the side of the frame opposite the wheels. Two speeds, controlled by a handle on the outside of the box, are provided. The machine has a capacity of 6 x 12 inches.

The table is pivoted in the center, so that it can be swung in either direction to allow long bars to clear the saw at the back of the machine. The saw guides are mounted on the table and swing with it, thus holding the saw at right-angles to the work at all times. Due to the construction, the saw is twisted only when cutting off long pieces, and then only sufficiently for the work to clear the saw at the back of the machine.

The movable carriage operating on the table is provided with a gravity feed. By changing the position of the weight on the lever, the pressure of the feed can be controlled. Stops are provided so that the travel can be adjusted. The work-holding vise is so mounted on the carriage that by loosening one capscrew it can be turned to permit of holding the work at any angle to the saw that is necessary. By removing this capscrew, the vise can be lifted off, thus leaving a smooth table 20 x 24 in. in size for use in cutting plates. An adjustable ball-bearing stock stand, shown at the right of the machine, is also furnished.

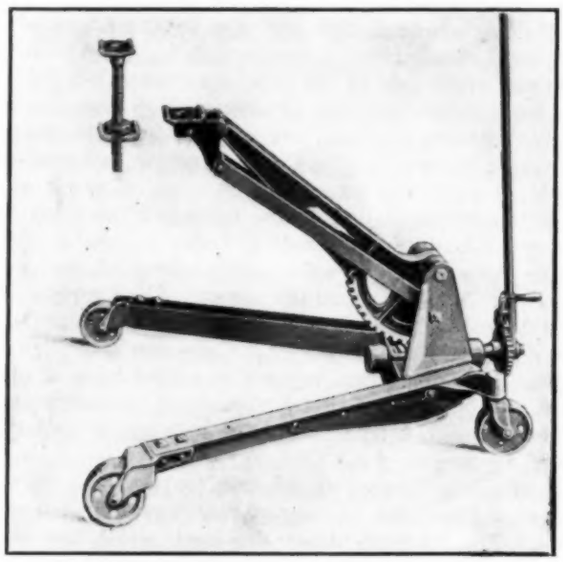
Weaver Hi-Lift Jack

The accompanying illustration shows the "Hi-lift" jack recently placed on the market by the Weaver Manufacturing Co., Springfield, Ill. The jack is intended primarily for use in garages for the lifting of trucks and passenger cars. It enables the operator to raise one end of the chassis, so as to provide sufficient room for working conveniently on the under parts of automobiles. By merely raising the weight of the car from its springs, such jobs as oiling springs and replacing broken leaves and worn shackle bolts can be performed.

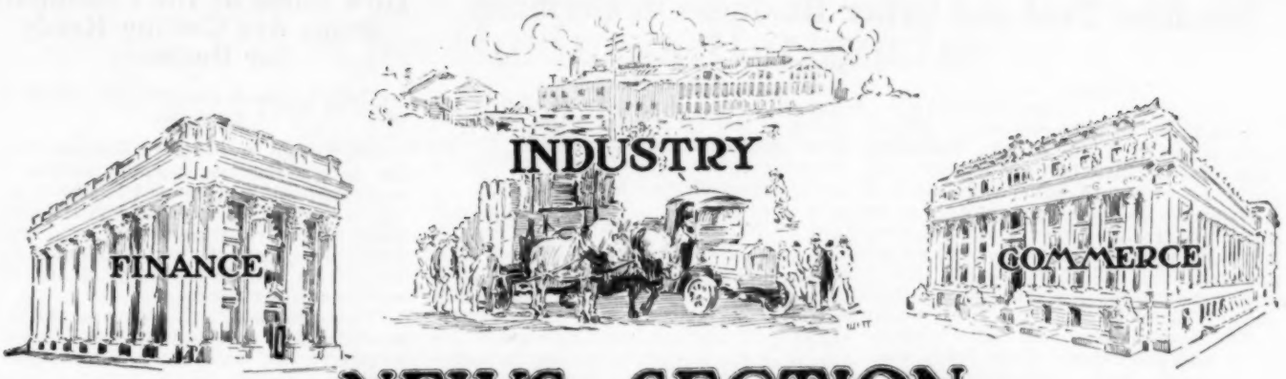
The jack is mounted on four casters, the two near the operating lever being provided with ball and roller bearings. The load rests on the end of the arm pivoted at the narrow end of the base. By means of a ratchet and worm and wheel, this arm can be raised or lowered. The operation is performed by means of the long lever shown at the right, although for rapid operation, the long lever can be removed and the worm turned by means of the crank. The travel of the saddle at the end of the arm is from a minimum height of 7 in. to a maximum of 38 in. from the floor. By means of the screw attachment shown, a maximum height of 45 in. can be obtained. Due to the fact that motion is not reversible through the worm gearing, there is no danger of the arm lowering unless the worm wheel be turned. No ratchet or catch is necessary to hold the mechanism at rest.

For the raising and carrying of truck wheels, an attachment can be fastened to the end of the arm, so that a plate on the attachment can be inserted underneath the wheel. Two small arms steady the wheel to prevent it from falling, and the clearance space allowed is sufficient to permit of the use of a wheel puller. The saddle is always in a horizontal position, due to the connecting links, so that there is no danger of the load sliding off.

The jack is made of steel and malleable iron, and has a lifting capacity of 3,000 lb. The maximum width is 40 in., so as to provide sufficient clearance for lifting truck wheels and yet permit the jack to pass between the front or rear wheels of a car. The jack weighs 225 pounds.



WEAVER HI-LIFT JACK



NEWS SECTION

Safety Congress To Meet in Detroit

Monster preparations are being made by the Detroit Board of Commerce for the annual Safety Congress of the National Safety Council, which will be held in that city during the week of Aug. 28 to Sept. 2. A committee of prominent Detroit citizens has been selected to arrange the details of what promises to be the greatest conclave of engineers and educators along safety lines that was ever brought together. S. C. Mumford, president of the Detroit Safety Council, is chairman of the convention committee. He is being assisted by representatives from civic and social bodies, welfare and industrial associations and the municipal and state governments.

Through the courtesy of the Board of Education, the meetings will be held in the new Class Technical High School. The school affords ample facilities for the exhibit of safety apparatus and devices, machinery and manufacturing processes. It is expected that nearly five thousand firms will exhibit their products.

Coal Enough for Forty-One Days

A report on stocks of bituminous coal has been prepared jointly by the Census Bureau and Geological Survey under direction of Secretary of Commerce Hoover.

The total commercial stock of this coal on Jan. 1, 1922, it is estimated, was 47,000,000 tons. This was 16,000,000 tons, or 25 per cent, less than the amount in storage at the end of the war.

In fact the stocks were found to be slightly smaller than on Nov. 1, 1921, when 48,000,000 tons were on hand. The public utilities and railroads, the report shows, have taken the precaution to increase their stocks during November and December, but their gains have been offset by a decrease in the stocks of industrial consumers and retail coal dealers.

The present stock is sufficient to last about forty-one days, if perfectly distributed. By classes of consumers, the figures are: Railroads, 35 days; coke plants, 42 days; steel works, 48 days; electric utilities, 51 days; coal-gas plants, 89 days; other industrials, 51 days. Retail coal yards have bituminous enough to last 33 days and anthracite sufficient for 44 days.

Railroad to Spend Forty Millions for Equipment in 1922

The Atchison, Topeka & Santa Fe Railway will spend $43,150,000 for improvements and new equipment in 1922, W. B. Storey, its president, announced last week at the close of the company's regular monthly board meeting. Of this he said $11,000,000 represents carry over from last year on work authorized but not done.

Mr. Storey said the expenditure would require no new financing, as the company has a substantial amount of cash and Liberty bonds in its treasury and a reasonable amount will also be provided from current earnings. He said the road's requirements were such that $60,000,000 annually should be spent for the next three years.

The 1922 outlay includes $11,750,000 for the completion of betterments already begun; $22,000,000 for new work, including 75 miles of new second track in Arizona; $1,400,000 for a new fifty-five mile line leading west from Santata, Kan.; $8,000,000 for new equipment; $6,662,236 for additional maintenance, and sums of $1,500,000 or less for such items as bridges, trestles, culverts, stations, office buildings, yard tracks, sidings, signals, shop machines, tools and assessments for public improvements.

Discontinue Temporary Ordnance Depots

The War Department has requested Congress to appropriate $1,642,351 for the removal of ordnance stores from temporary to permanent ordnance depots, to permit disposition of the temporary depots. It is estimated that the Government will realize $3,500,000 in disposal of surplus ordnance material, and save at least $400,000 a year by discontinuing temporary depots. In the interest of economy it is planned to move the material to the nearest point where permanent storage is available.

A. S. T. M. Meeting To Be Held in June

Notice has just been received that the twenty-fifth annual meeting of the American Society for Testing Materials will be held in Atlantic City, N. J., from June 26 to July 1. Headquarters will be at the Chalfonte-Haddon Hall Hotel. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa., is secretary of the society.

Machine Tool Builders Revise Constitution

The committee of the National Machine Tool Builders' Association, which was appointed to revise the constitution of that body, has completed its work. The document with the changes will be submitted for the approval of the members at the annual meeting to be held in May.

The committee consisted of O. B. Iles, International Machine Tool Co.; Paul E. Thomas, Kempsmith Manufacturing Co.; and H. P. Dix, Wilmarth & Morman Co.

Cadillac Tool Co. Officials Form New Organization

The Cadillac Tool Co., of Detroit, Mich., has been dissolved and the officers of that company have banded together in a new organization which is to be known as the Cadillac Machinery Co. This change came about following the death of Percy M. Fowl, president of the tool company. Mr. Fowl requested that the business which he started some years ago, be carried on by his associates.

The new company will not manufacture machinery, but will engage in the sale and distribution of tools and machinery in the same territory in which the old company operated. Salesrooms have been opened at Lafayette and Beaubien Sts., in Detroit. C. L. Campbell is president of the new company. Others associated with him are C. E. French, L. E. Bugbee, C. G. Valentine and R. J. Borneman.

Standards Committee Approves Specifications of Testing Society

The American Engineering Standards Committee has approved as tentative American standard the specifications of the American Society for Testing Materials for: cold-drawn bessemer steel automatic screw stock (A32-14); cold-drawn open hearth steel automatic screw stock (A54-15); methods of chemical analysis of manganese bronze (B 27-19); methods of chemical analysis of gun metal (B 28-19).

These specifications may be found in the 1921 volume of "A. S. T. M. Standards." Copies may also be obtained from the American Engineering Standards Committee, 29 West 39th St., New York City.

Machine Tool and Other Business in Germany

By H. A. Carstens
American Manager, Alfred H. Schutte, Cologne, Germany

Germany is busy—very busy. Prices have been going up as the exchange value of the mark has gone down, but the peak seems to have been reached although no one can say definitely as to that. Wages have been going up also, but neither prices nor wages have kept pace with the fall of the mark. Early in December, 1921, a mechanic earned about 15 marks, 15 pfenigs per hour, or about 70 cents a day. He must exercise great care but can get along fairly well. As compared with 1914 we may say he is, perhaps, 60 per cent as well off as then.

The worst feature is that nothing is settled; there is as yet no assurance as to the future. But everyone is working, and working hard. First, to forget the horrors of the past and to have something definite to do; second because without work even the necessities of life cannot be obtained.

The fact that Germany cannot entirely feed herself adds to the difficulty, as the food that must be bought from outside is very high at the present rate of exchange. But in spite of this life is bearable, if not comfortable, owing to the willingness and desire of the people to work and to produce. And some shop managers state that labor is ten per cent more efficient than before the war.

Machine Tool Shops

Machine tool and other machine shops are busy. Plants are being well equipped to produce all sorts of goods, because it is realized that only by exchanging manufactured products can business be returned to normal. Some exporting is being done, the rate of exchange aiding in this but hindering in the purchase of raw materials or machinery from outside countries.

Germans are naturally frugal and hard-working and the necessity of the present situation is making these traits even more of a national habit. Economy and efficiency are the watchwords and the results should be evident in the years to come. But after one has lived in Germany for a few months, he stops trying to prophesy or even speculate on the future. The natives have learned to live each day unto itself, almost without thought for the morrow, as there seems to be little or nothing on which to base one's judgment.

Desire to Trade with the United States

One great desire of Germany at present is to get back to doing business with the United States. Her goods of many kinds are coming to this country in increasing quantities. But Germany realizes that in the long run all business comes down to an exchange of commodities, and she cannot buy our machinery at the present rate of exchange. She can and does take our money because it can be used in exchange with other countries, but to take our machinery and commodities is quite another matter.

The whole problem of exchange is decidedly puzzling. The bankers do not attempt to explain it much more than do the common people. Here is a land with practically no gold and business going at top speed; while the countries with gold, and particularly the United States with the bulk of the world's gold, have unprecedented idleness.

United States Notes More Desired Than Gold

An unusual experience in the summer of 1921 may be of interest. Wishing to secure some German marks, I went to Cook's Agency and asked the value of $10 American money in marks. The answer was 840, but when I produced a $10 gold piece, the rate rose to only 720 marks for $10. The paper money of the United States would buy over 16 per cent more marks than a gold piece. This is because gold cannot be exported from the country on account of the treaty.

Except for the occupied districts there is no evidence of revengeful or warlike feelings on the part of the people. The war is over, and the people are working to forget it as much as possible. The occupied areas are no more quiet than they would be elsewhere under similar conditions, and the American and English troops get on well with the natives.

For geographical and other reasons, Germany seems destined to secure a large part of the trade with Russia. The International Harvester plant at Moscow is at work and while not up to capacity, is turning out some agricultural machinery. All this is being used in Russia but she needs still more, which Germany is likely to supply.

What the future of Germany will be no one can tell, but if hard work, economy and the desire to again do business with the United States count for anything, she will work her way out in time. And perhaps sooner than some think.

Standardizing in Japan and Norway

Standardization work in Japan has recently been given a great impetus by the organization of the Japanese Engineering Standards Committee. The main function of this committee is to serve as a bureau for solving and initiating problems involving engineering standardization. The committee consists of seventy members presided over by the minister of the Department of Agriculture and Commerce, acting as president. The details of the work are handled by seven secretaries who are engineers in the government service. The work is being pushed with vigor, investigations already being under way on metals, woods, brick, screws, electric wires and electric motors.

In Norway a national standardization committee has been organized by the Federation of Norwegian Industries. One of the first projects which is being taken up by the new committee is the standardization of ship machinery and ship details.

There are now national standardizing bodies in the following fourteen countries: Austria, Belgium, Canada, Czecho-Slovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden, Switzerland and the United States.

How Some of the Cincinnati Shops Are Getting Ready for Business

The Lodge & Shipley Machine Tool Co.

The Lodge & Shipley Machine Tool Co. is making no special changes in equipment as replacement has been going on during the past five years. Old machines were weeded out and sold when the price of used machines was high. As a result nearly all of the equipment is modern.

The company is, however, shifting machines to meet present and future requirements, utilizing its newer and modern buildings so as to secure better light, ventilation, etc. Line shafts, jack shafts and many machines have been equipped with ball bearings. Grinding and polishing heads, outboard bearings of motors, snagging grinders and tumblers all have all bearings. Shut downs and expensive delays have been eliminated. The bearings are thoroughly cleaned out once a year, using benzine or gasoline to cut out the old grease. They are repacked with a light grease—not too full—and are promptly forgotten for another year.

Another noticeable feature is the large amount of room allowed to each machine in the new shop. The output has, in several cases, been increased by reducing the number of machines and allowing more room for the man and his work. And there is no question as to its making a better looking shop in every way.

Cutting oil also receives careful attention. It is filtered and cleaned before being used again. The company's experience indicates that it is far more important than many realize to keep the oil clean and free from chips and fine particles. So doing makes possible more accurate work and less scrap.

The Acme Machine Tool Co.

The Acme Machine Tool Co. is also an example of gathering several branches of the industry under its roof, for example, the Champion lathe, which is built in four sizes, 13 in., 15 in., 17 in., and 19 in. and the Super-Matic, which is a machine distinctive in design, fully automatic, and with greater production possibilities in the manufacture of small parts for automobiles, cash registers, adding machines, electrical work, etc.

This company has taken advantage of the depression to put everything in first class shape both as to building and equipment. In common with others it has replaced some of its machines with newer models, thoroughly overhauling and conditioning the old machines before selling them.

Niles-Bement-Pond Shows Deficit

A recent report issued by Niles-Bement-Pond Co., New York, machine tool manufacturers, shows a deficit of $2,737,434 for the year ending Dec. 3, as compared with a net income of $1,031,522 for the previous year.

After deducting dividends amounting to $620,925 there is a deficit of $3,358,359 for the year. That deficit applied to the previous profit and loss surplus made that account $12,649,923 at the close of the year.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Some one suggested that last week should be called "Smile Week" and that we should all observe it by looking pleasant and being cheerful. The newspapers took the idea up but everyone treated it as a joke. This induced the smiles desired and a willingness to look on the bright side of things.

So subtle is the relation between the popular mood and the markets that it is quite possible that the higher prices generally recorded may be in part due to Smile Week. But whatever the cause prices are up and nearly every one seems more optimistic. Wheat has had a substantial gain. Corn has advanced. Hogs and hog products are firmer. Cattle are slightly higher. Cotton refuses to decline. Wool continues to improve. Rubber is in better demand. Sterling exchange advanced, while those vultures of hard times, the bucketshops, are failing or running to cover. What is called an "old fashioned bull market" is developing on the Stock Exchange, though just why it should be described as old fashioned no one knows.

The improvement in sterling has naturally made London more cheerful and there as here a distinct revival of the speculative spirit is noticeable. A recovery so general and all embracing must, however, have something more behind it than a jocular suggestion that we should all take laughing gas and those who look deeper for its cause are coming to agree with the writer that it is the inevitable result of the inflation in progress and in prospect.

Bonus Means Inflation

In a circular issued last week the Baltimore bankers, Nelson Cook & Co., express the view now generally accepted among financiers in saying "The distribution of a bonus averaging only $300 to each soldier would mean another era of inflation shorter and sharper than before, but far more serious in its effects. There would at once be a decided increase in the cost of living, food, clothing, and commodities would advance sharply as the demand for them progressed, and we would have a brief anti-climax which would leave the commercial world in a more prostrate condition after this second spending period than was the case after the orgy of extravagance which followed the Armistice."

This prognosis is one which every intelligent student of economics and financial history will endorse and while experts may differ as to the duration of the inflationary period they all admit its imminence and the importance of knowing when we ought to get off a train whose speed is now increasing day by day.

As yet the movement has hardly started, but it is developing according to precedent. Agricultural products, which were the first to decline when deflation started have been the first to advance. The stock market has followed, and there has been a distinct improvement in the demand for low-priced shares, especially railway shares, upon the theory that an increase in the purchasing power of the masses means more travel and more freight traffic.

But the markets through which the manufactured products of the country are distributed have hardly moved. The dry goods trade is still slack. The grocery markets are quiet. With a few bright exceptions, automobiles are hard to sell. The leather trade is dull, though it is improving. The mail order houses are not increasing their sales. The steel makers continue to whistle cheerfully for wind and the demand for copper has been checked by the figures of the Geological Survey which show stocks substantially in excess of the current demand despite a reduced production.

All this is as might have been expected. A change will be seen just as soon as the proceeds of the bonds now issued and to be issued get into circulation.

A Buyers' Market

That retail dealers appreciate conditions and are preparing for them is indicated by a statement published in the *Daily News Record* on Feb. 7, in which it was asserted that 876 buyers were listed in that paper as having just arrived in New York the day before and that this number was largely in excess of any previous record. It is therefore logical to expect an early increase of activity in the jobbing and retail trades and a continuation of the upward movement on the Stock Exchange until the entire gamut has been run and a reduction in bank reserves again indicates the approach of the necessary and inevitable contraction.

Just when this reverse movement will commence no one can say. It will depend upon the rapidity of the expansion, which has hardly commenced as yet, for the weekly statement of the Federal Reserve System shows a reserve ratio that is practically unchanged at 76.1 per cent because a further gain of $10,000,000 in gold holdings about offsets an increase of $25,000,000 in deposits.

The upward movement which seems to be in prospect will of course be punctuated by reactions that will be temporarily depressing, but there is every indication of a broad and general advance in prices that will not be halted until bank credit becomes scarcer unless we encounter some national or international cataclysm that cannot be foreseen.

These are the probabilities as I see them, but it must be admitted that there are many reasons why the predicted inflation may be prevented or fail to produce the result expected.

One is that both its imminence and effect are obvious and the obvious is often discounted before it occurs. Another is that there is so much opposition to the Federal Bonus bill and the additional taxation that it will involve that there is a bare possibility of its defeat. This is, however, very unlikely.

A third is the impecuniosity of the farmers, who do more than half the buying in the twenty-nine "best business States" of the country. The Senate has passed the bill legalizing agricultural co-operation, but helpful as it will be the effect cannot be immediately felt.

Then there is the coal strike so widely advertised for April 1, and the threatened extension of the strike among the textile workers of New England. They may breed trouble if they occur, though it is true that the expected rarely happens.

The possible postponement of the Genoa Conference if the United States refuses to be represented is another disturbing factor and in Europe as well as here many minor difficulties are to be discerned. They need not be catalogued. There are always difficulties to be seen if we look for them. The question is will their influence restrain or prevent the commercial and financial distention that will follow the expenditure of the two or three billion dollars that Congress and the other legislative bodies of the country seem bent upon distributing among the people in the near future.

Every one must answer this question for himself. It cannot be evaded for it is a condition rather than a theory that confronts us and whether we like it or not we must be prepared for heavier taxes and intelligent in appraising their effect.

Southern Committee to Equalize Freight Rates

At a recent meeting of the Southern Freight Rate Committee in Atlanta a promise was made to representative business interests of the ports of the South Atlantic that these ports will be placed on an equitable basis with the Gulf ports, through the abolishment of preferential railroad rates on shipments to the west coast. At present Gulf coast ports of the South enjoy an advantage, for port charges at South Atlantic ports are assessed by the carriers in addition to the freight rates, and not absorbed as they are at the Gulf ports. The committee also promised that it would either also absorb port charges at Gulf ports or abolish them. Either of these changes in tariff would place South Atlantic ports on an equal footing with Gulf ports in bidding for the rapidly growing trade Southern industry is experiencing with the Pacific coast.

On iron and steel articles, particularly on cast-iron pipe which forms a large part of the commerce with the Pacific coast, the charges assessed at South Atlantic ports add a rate cost of a few cents per hundred pounds as compared with Gulf ports, and therefore prohibits the handling of any of this business.

The Trend of Business Improvement—Plants Resuming

The Pennsylvania Pump and Compressor Co., Easton, Pa., has adopted a full time operating schedule at its plant, following partial time operations for some weeks past.

The Pennsylvania Railroad Co., is increasing operations at its car shops at Logansport, Ind., and about 250 men were added to the working force.

Pusey & Jones, Wilmington, Del., have resumed operations at their local shipyard, following a suspension for more than a year. The company has taken contracts for the construction of two vessels for the Seaboard Bay Line, Baltimore, Md., a subsidiary of the Sea board Air Line Railway Co.

The New Haven Clock Co., New Haven, Conn., has resumed manufacture at its plant, giving employment to about 1,500 operatives. The factory has been closed for several weeks past.

The Grand Trunk Railroad has reopened its car shops at Battle Creek, Mich., and will give employment to over 550 men.

The Slatington Iron and Steel Co., Slatington, Pa., has resumed operations in a number of departments at its local mill, following a shut down for many months past.

Creasy & Wells, Bloomsburg, Pa., have commenced production at their new local planing mill, and plan for immediate increase in operations. Additional machinery will be installed and new workers added to the force.

The New York Central Railroad Co. will increase operations immediately at its shops at Oswego, N. Y., adding about 100 men to the present working force.

The W. & B. Douglas Co. Middl town, Conn., manufacturer of pumps, hydraulic rams, etc., is increasing production at its plant and has adopted a five-day working schedule in the several departments; the foundry is working on a four-day operating basis, following a curtailment for some time past.

The American Car and Foundry Co., 165 Broadway, New York, is arranging for increased operations at its plant at Terre Haute, Ind., which for a considerable time past has been running at about 50 per cent of normal. New forge and machine shops are being completed, replacing structures destroyed by fire several months ago, and the buildings will be placed in service as soon as available, with increase in working force. The company has orders on hand for about 900 railroad cars.

The International Harvester Co., Chicago, Ill., has resumed operations at its works at Milwaukee, Wis., following a suspension for some time past. The plant is devoted to the manufacture of farm tractors, farm engines, cream separators and other agricultural products.

The Western Maryland Railroad Co., Baltimore, Md., has leased its car and locomotive shops at Elkins, W. Va., to W. K. Hosier, private contractor, who will operate the plant for contract work for the railroad, giving employment to about 100 men.

The Automotive Foundry Co., Freeland, Pa., manufacturer of automobile parts, etc., has resumed operations with a full working force, under normal schedule. A number of improvements have been made at the works for increased efficiency.

The Grant Lees Gear Co., 2365 East 69th St., Cleveland, Ohio, manufacturer of automobile gears and transmissions, is arranging for an immediate increase in working force to about 600 men, or more than 300 additional employees. A night working shift will be placed in effect at once. The company is said to have orders on hand to insure capacity production throughout the present year.

The L. C. Smith & Brothers Type writer Co., Syracuse, N. Y., has increased operations to a five-day week schedule, following a four-day week basis since last June.

The General American Tank Car Corporation, Chicago, Ill., is arranging for immediate increase in production at its different plants, which have been running at about 75 per cent capacity for some time past. The works are located at East Chicago, Ind.; Warren, Ohio; and Sand Springs, Okla.

The Seminole Construction Co., Buffalo, N. Y., has reopened the local car repair shops of the Erie Railroad, recently secured under lease, and will operate the plant for contract work for the road. Immediate employment will be given to about 350 men and this force will be increased at an early date.

The Standard Parts Co., Cleveland, Ohio, has taken an order from the Wills-Sainte Claire Co., Detroit, Mich., manufacturer of automobiles, for axles to an amount approximating $1,000,000. The contract will insure capacity production at the local Eaton axle works of the company throughout the year. Shipments will be commenced in March.

The Cleveland, Cincinnati, Chicago & St. Louis Railway Co. has resumed operations at its shops at Beech Grove, Ind., following a shut down for several weeks. Employment will be given to about 900 men.

The Cadillac Motor Car Co., Detroit, Mich., is operating at its new plant in that city at capacity, with normal working force. A regular production schedule is being maintained.

The Southbridge Foundry Co., Southbridge, Mass., recently organized, has commenced operations at a one-story plant on Worcester St., and will give employment to about thirty molders and other operatives. Frank S. Mills is president and general manager.

The Phoenix Iron Works, Meadville, Pa., has adopted a daily working schedule of three 8-hour shifts, and will maintain this capacity output for an indefinite period. Work is being concentrated on steel tank manufacture for oil storage service.

The Columbia Malleable Castings Co., Columbia, Pa., resumed operations at its plant on Feb. 6, following a period of idleness of several months. The working force will be increased gradually until normal is reached.

The Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa., announces a marked increase in the sale of large power apparatus in 1922, with January sales of $1,500,000 in turbine-generators and condensers. Some of the companies purchasing this apparatus were Pennsylvania Edison Company of Easton, Pa.; the Madison (Wisconsin) Gas and Electric Co.; the North Carolina Light and Power Co. The Takata & Co., of Japan, has ordered another large turbine-generator for one of its new plants. Fifty steam auxiliary units were sold during the month for a wide range of applications, many of the purchasers being industrial power plants.

W. N. Durbin, head of the Anderson Foundry and Machine Works, Anderson, Ind., reports that business continues good and that the factory is working full time. The testing room is being operated days, nights and Sundays.

The U. S. Radiator Co., which has headquarters in Detroit, Mich., has taken a lease on the Bryant Building in Columbus, Ohio. A force of workmen is making the necessary alterations. A large stock of radiators and all kinds of heating equipment will be carried in the Columbus branch.

The Boston & Albany Railroad Shops at West Springfield, Mass., resumed work last week after a shut-down. Four hundred employees returned to work.

W. H. Morsches, superintendent of the Nicholson File Works, Anderson, Ind., stated recently that the plant was gradually taking on some of its former employees as business warranted, and that the business outlook for the coming year was good.

Indication of better progress in the metal-working industries in the Cleveland, Ohio, district, is shown in the increase of employment in plants in that city. The Clarkwood plant of the Steel Products Company employed 100 additional men last week, bringing the total up to 750 men, officials announce. In the Detroit plant 200 out of 350 of the normal number now are employed. January business was 50 per cent greater than December, the company's figures show, and February promises to pass January by a like gain. The company manufactures automobile parts, principally bolts and valves.

The Fafnir Bearing Co., New Britain Conn., reports that orders are coming in and that the shop is now running on full-time with as many of the old hands as conditions will permit.

Idle Freight Cars Drop 38,000 in One Week

Reports from the railroads of the country to the car service division of the American Railway Association show that 555,353 freight cars were idle on Jan. 23. This is a reduction of 37,945, compared with the total on Jan. 15.

The report states that 396,192 of these were surplus freight cars, that is, cars in good repair and immediately available for service if traffic demands warranted, which was a reduction of 43,790 cars compared with the number of such cars at the middle of the month. The remaining 159,161 were idle freight cars in need of repairs, in excess of the number normally regarded as being in bad order.

Surplus box cars totaled 159,109 or a reduction within a week of 31,071; surplus coal cars amounted to 183,999, or a reduction within the same period of 11,285. Coke cars showed a reduction of 283 which brought the total to 4,542, while stock cars totaled 20,679 or 949 less than on Jan. 15.

Tabulations showed 319,512 freight cars in need of repairs on American railroads on Jan. 15, which was 13.9 per cent of the cars on line. On Jan. 1, there were 313,190 or 13.7 per cent. Allowing 7 per cent of the cars on line as being normally in need of repairs would leave 159,161 as representing the number of bad order cars which were idle on Jan. 15 because of business conditions.

New England Letter

During the long and tedious period of inactivity through which the machine tool and allied industries have passed and the end of which we hope we can now see, few New England shops have been altogether idle. When customers declined to order more machinery at any price, and shops found that they could not go on building indefinitely without reaching the limit either of storage space or capital, or both, there were just about two things that could be done: to take stock of their physical condition and put it in shape to handle new business to advantage when it finally arrived, or, to develop new machines or lines of machinery that would enable the users to get out work faster, cheaper, or better than they had heretofore done.

Many New England shops did one or other of these two things; not a few did both. Lathes, planers, drilling and milling machines, etc., were overhauled; bearings were taken up or new ones fitted; new spindles made in some cases, and sliding surfaces scraped and realigned.

The reconstruction included the cutting of new gears where the old ones showed signs of wear, replacing lead- and feed-screws with new ones, replaning the tables and scraping the beds of planers as well as the replaning and realignment of housings, crossrails, etc. All the belts were removed, new joints made, and the belts slushed with hot tallow and rolled up; each ready to go back into its respective place at a moment's notice and to perform its allotted service for a long time before requiring the services of a belt doctor.

Line shafts were polished, oiled and put into perfect alignment, new bearings being placed wherever the condition of the old ones indicated that replacment might become necessary within a reasonable time. Overhead carrier systems were inspected, strengthened and extended to cover points not hitherto reached by them but which might possibly be served to better advantage in the future by having them.

Trolley, chain blocks, air hoists and all other mechanisms connected with the carrier system were carefully inspected and any apparent weaknesses remedied. Electric wiring, switch boards, motors, etc., were also carefully gone over as well as the various pipe lines that enter into modern machine shop equipment.

To give the drafting office a chance, charts of all wiring and piping were prepared so that when trouble develops in the future—as trouble surely will—the man in the office can tell by a reference to his chart what valve to close or switch to open in less time than the electrician or plumber could trace the defective wire or pipe back to the next department.

One shop, at least, is trying the experiment of enameling all its machinery white, and the effect in the way of lightening up the interior is surprising.

Repairs to buildings also come within the province of slack time work. Windows are fixed and cleaned, roofs mended, floors relaid and partitions moved or built.

The guarding of heavy belts, gears, and other moving machinery, that are or may become a source of danger to operatives, is another way of utilizing the surplus time to advantage.

All these schemes mean more than the mere making of work to keep otherwise idle hands busy. It is work that will have to be done eventually, anyway, and the doing now is a practical form of insurance against the future piling up of that insidious item of expense known as "overhead."

In the development of new machines the New England shops are by no means behind their contemporaries. Not so many have appeared on the market as yet, but in more than a few shops there are machines under construction or already completed that are destined to make changes in some of our methods of production. To mention these by name would be to release prematurely the secrets that some of the builders are carefully keeping up their sleeves, but they will all be heard from in due course.

The market for used machinery, though far from what we are pleased to call normal, is still away out of proportion to the demand for new. Some of the builders of the heavier machines are taking advantage of this condition and are selling as second-hand their own used machines taken from the shop floor, replacing them with new product of the same or improved types, thus creating a certain volume of business that they otherwise would not have, and at the same time putting their shops into the best possible shape for the handling of new work.

Taken altogether, this business depression, without doubt the most general and far reaching of any in our history, has not been altogether without compensation. It should, among other things, teach the value of a reasonable amount of conservatism. As there is danger in being too cautious, there is also danger in not being cautious enough. Rapid expansion is reasonably sure to be the forerunner of equally rapid deflation.

We have paid too much attention to production and not enough to the foundation upon which production is built. In rearing the new structure of business prosperity that is before us, let us give a due proportion of our attention to the minuter detail, and not put off until tomorrow the things that ought to have been done yesterday.

Cincinnati Letter

While conditions in the Cincinnati district are generally spotty there is discernible a distinct improvement both in inquiries and in orders. As yet, the improvement is not greatly reflected in increases in number of men employed or in hours work.

One lathe builder doubled his October business in November and doubled this again in December. His January sales held up well. Another concern reports sales of forty-two lathes during the first week in February, thirty-seven of them on one order to one of the big automobile companies in Flint, Mich. Cincinnati seems to be getting her share of the little railroad business that is being placed, and the outlook for more orders in this field is good.

Progress continues in the preparation of shops and equipment for economical production when prosperity returns. At the American Tool Works Co., for example, the whole equipment of twenty-four radial drills has been disposed of to be replaced by eighteen of the latest type which will have a greater total capacity than the ones replaced.

Chicago Letter

Inquiries for machinery are slowly but steadily growing more plentiful, especially from garages and service stations. The inquiries as a whole are coming from local concerns and are for second-hand and miscellaneous equipment. It is admitted that auction sales, scalpers, and sales of second-hand equipment at cut-throat prices are interfering with the regular business, but several manufacturers who have purchased machines at auction sales, have discovered that it is better, and perhaps more economical, to obtain equipment from dependable sources. Along this line comes a report from a local second-hand dealer, who has been a steady customer at numerous auction sales, that he has done 100 per cent more business during the last month than he did in any month in 1921.

As has been stated, the manufacturers of garage and repair shop equipment are doing a wonderful business. A local concern, manufacturers of a medium weight lathe suitable for use in garages, is working full force and is well supplied with orders for immediate delivery. Furthermore, these orders are increasing, due to the fact that the manufacturer has reduced prices to a point where he must rely upon output to carry him through. Another reason for these orders is that a large nationally known automobile accessories jobbing house has recently looked upon the machine tool and the garage man in a very optimistic light, and is endeavoring to interest the garage man in equipping his service station with the proper machine tools.

This jobbing house has interested a large local taxicab company in this idea, and in all probability will equip a new plant which the taxicab company is about to purchase. This will mean a sale of many thousands of dollars.

The railroads are quiet, as usual. The Sante Fe has made additional purchases, and at the present time is inquiring for a 10-ft. gate shear with a 20-in. stroke, capacity to cut $\frac{3}{8}$-in. metal.

To add to the outlook toward a good year in the machine tool and machinery field, a large number of repair shops, foundries and factories will be erected this summer. R. Johnstone, 1,553 Burchwood Ave., will award a contract soon for the erection of a two-story automobile repair shop to cost about $25,000.

Limitation of Armaments Causes Lay-off in Navy Yards

Furlough by the Government of 1,350 Navy yard employees and of 1,500 employees of the South Charleston, W. Va., armor plate plant, due to a suspension of warship construction pending action by Congress on the proposed treaties limiting armament, has caused labor leaders to appeal to the Government to provide work for the men thus thrown out of employment. Representatives of the International Association of Machinists will confer with Navy officials Wednesday to determine whether the Government can provide some work for the men at the Washington Navy Yard. It will be pointed out that the Government is unfair in letting out its Navy yard employees, while at the same time giving government work out under private contract.

Otis Zone Managers See New Machines

The several zone managers of the Otis Elevator Company met in the main office, New York City, on January 23, for a three-day series of lectures and inspections of the latest types of Otis elevator apparatus. The meeting was held under the personal supervision of the president, F. C. Furlow, and was attended by the managers from all over the United States, Canada, South America and Europe.

One of the main features of the meeting was a visit to the Otis plant at Yonkers, where the managers inspected the latest machine designed by Otis engineers. The machine, with its component installations, was set up for operation in the plant. Edward A. Fitch, superintendent of the plant, supervised the exhibition. Every phase of construction and operation of the mechanism was fully explained to the managers. The special manufacturing machines, jigs and fixtures, cars and parts also were shown. Otis chemists had arranged a separate display, showing how the metals put into the machines are tested and analyzed in the laboratories before going to the shops.

The zone managers present at the conference were: G. Beardsley, New York; R. W. Charles, San Francisco; H. S. Wells, St. Louis; C. J. Comstock, Cleveland; G. R. Rebmann and E. W. Deacon, Philadelphia; R. H. Carter, Boston; S. Cronk, Omaha; Mr. Zeeryp, Houston; M. D. Hoffman, Atlanta; C. Clarke and Mr. Scott, of London, England; S. Jacquet, of Paris, France; C. T. Furlow, Jr., of Argentina; Messrs. Black, McLoughlin and Burgis, of Canada.

Drives 1,544 Rivets a Day for a Month

L. M. McNeil, a Pennsylvania Railroad mechanic, employed in the railroad car shops at the Altoona works, in Pennsylvania, drove an average of over fifteen hundred rivets a day for a period of one month. McNeil, with his two assistants, is employed in repairing locomotives and steel freight cars.

During the month of December, 1921, McNeil, with the two other members of his riveting gang, drove an average of 1,544 rivets a day of eight hours. The maximum number driven in any one day was 1,981 (nine hours).

The gang, which consisted of the riveter (L. M. McNeil, car builder), a holder-on (R. W. Ray, helper) and a heater (R. C. Yingling, helper), averaged on the day of maximum output practically four rivets per minute throughout the day. They averaged three and two-tenths rivets for every minute they worked during the month of December, 1921.

More Census Figures

Texas had 11,893 machinists and toolmakers when the 1920 census was taken. This compares with 5,756 in 1910. The census report for Florida shows that that state had 4,054 machinists in 1920, as compared with 1,475 in 1910. The number of machinists in Buffalo in 1920 was 10,501. While the 1910 returns showed 6,856 machinists in Buffalo. In 1920 Buffalo had 504 mechanical engineers, as compared with 156 in 1910.

Hiram Percy Maxim Addresses Waterbury Engineers

Hiram Percy Maxim gave an interesting talk to the members of the Waterbury branch, American Society of Mechanical Engineers, on the evening of Tuesday Feb. 7. His subject was the "Silencing of Industrial Noises."

Mr. Maxim prefaced his talk with an explanation of the natural action of gases escaping from an orifice under pressure, and gave a brief summary of the experiments along other lines that led up to the invention of the Maxim silencer. He then explained how sound waves could be photographed by means of special apparatus in such a manner as to leave a visual record of their behavior in confined spaces and under the influence of various baffle plates or deflectors, and showed lantern slides displaying their actual movements in the various experimental devices.

He then told of the application of the principles involved to objectionable noises common to industry, such as gas and oil engine exhaust, high pressure steam discharge, safety valves, air compressor intakes, etc., and showed pictures of successful installations.

Service Session of S. A. E.

The mid-winter session of the Society of Automotive Engineers was held on Feb. 1, in the rooms of the Western Society of Engineers, Monadnock Bldg., Chicago.

This meeting was given over to a discussion of the engineering phases of the service problem, and due to the large attendance and the spirit in which the problems of service were received, it is planned to make this Chicago meeting a service meeting every year.

Papers read at the meeting were as follows: "A Service Man's Critical Estimate of Automotive Engineering," by B. M. Ikert; "The Car Owner and the Service Man," by J. F. Page; "Commercial Body Supply and Service," by C. M. Manly and C. B. Veal; "The Progress Made in Garage Equipment," by H. C. Buffington; "Service As It Isn't," by Howard Campbell.

A dinner was given at the Drake Hotel in the evening, at which Col. H. M. Byllesby, of H. M. Byllesby & Co., bankers, of Chicago, and R. H. Grant, general manager, Delco-Light Co., were the speakers.

Shipping Board Selling $10,000,000 Yard at Bristol

The entire complement of buildings, machinery and equipment of the Merchants Shipbuilding Corporation Yard at Bristol, Pa., is being dismantled and sold by the United States Shipping Board. W. P. Willetts, of the Emergency Fleet Corporation, is in charge of the sales. The yard was one of the best equipped during the war and its selling price is only a fraction of the original cost of construction. About ten million dollars worth of machinery, tools, cranes, building materials, iron and steel, electrical apparatus and miscellaneous supplies are still to be disposed of. Bids are open during this month and next. A circular giving complete information and details of the sales can be had from Mr. Willetts.

Printing Office Needs New Machinery

Installation of needed machinery in the Government Printing Office has been deferred until prices decline, according to a statement of Public Printer Carter before the House Appropriations Committee. "A plant the size of the printing office with its machinery and equipment costing about two million dollars is constantly in need of new machinery and equipment," said Mr. Carter. "I have felt however that it is inadvisable to buy new machinery until normal conditions are restored in the manufacture of printing machinery, the price of which has been up fully 100 per cent and sometimes as much as 200 per cent over what it was before the war. As soon as conditions become normal the printing office will have to replace much of the machinery that is now almost worn out." He said $200,000 could be spent now for new machinery. One press at the office had been running for thirty-six years, one twenty-seven and one nineteen years. The office now has a press that prints sixty-four pages and two others printing thirty-two pages each. He favored a ninety-six-page press which would cost $50,000.

With increased printing for the Patent Office due to enlargement of the patent office under pending legislation, he said the printing office should have from ten to twenty additional typesetting machines, costing about $4,000 each.

Engineers Discuss Power-Plant Development

Nationwide power plant changes would largely remedy the present industrial depression, John S. Griggs, Jr., consulting engineer of New York City, asserted at a forum of New York, Philadelphia and Schenectady engineers on "Industrial Power" held Jan. 27 in the Engineering Societies Building, New York City. Mr. Griggs stated in a speech, in which he outlined the power changes in the last twenty-five years, that the possible coal saving in this country through power plant changes would fill two million 45-ton cars.

David Rushmore, of Schenectady, presided at the meeting which was under the auspices of the Metropolitan Section of the American Society of Mechanical Engineers and the New York Section of the American Institute of Electrical Engineers. Harold Goodwin, Jr., of Philadelphia, spoke on "Steam Electric Power for the Industries," and prominent engineers took part in the discussion following the two principal addresses.

Rivers and Harbors Meeting at Washington in March

On March 1 and 2 the National Rivers and Harbors Congress will hold its seventeenth convention in the New Willard Hotel. Secretary Weeks has designated Maj. Gen. Lansing H. Beach, chief of engineers, U. S. Army, to speak as the representative of the War Department. The evening session on Wednesday, March 1, is to be devoted to a discussion of the proposed St. Lawrence River Ship Channel.

Rail Engineers and Steel Makers Join A.E.S.C.

Beginning with 1922, the Engineering Division of the American Railway Association and the Association of American Steel Manufacturers became member-bodies of the American Engineering Standards Committee.

The Association of American Steel Manufacturers is an organization of forty iron and steel manufacturing companies. Its activities are limited to the standardization of rolling mill practices and to the standardization and inspection of iron and steel products. The association was organized in 1895. Its official representative on the standards committee has not yet been designated.

The Engineering Division, which is intimately connected with the American Railway Engineering Association, the two organizations having the same officers, covers broadly the civil engineering activities of the railways. E. A. Frink, of the Seaboard Air Line Railway, represents the American Railway Association (Engineering Division) upon the standards committee.

These two new member-bodies bring the total number of national organizations represented upon the American Engineering Standards Committee up to twenty-eight, and of representatives to fifty-two.

Calendars Received

The AMERICAN MACHINIST acknowledges with thanks the receipt of 1922 calendars from the following firms:

Long & Allstatter Co., Hamilton, Ohio; Charles A. Schieren Co., Inc., Dallas, Texas; Philadelphia Gear Works, Philadelphia, Pa.; Columbian Rope Co., Auburn, N. Y.

Automotive Production Lower in 1921

It is estimated by the National Automobile Chamber of Commerce, that automotive production in 1921 amounted to 1,680,000 cars and trucks, a decrease of 24 per cent from the previous year. Of this total 1,535,000 are automobiles, and 145,000, trucks. The wholesale value of cars and trucks, factory price, was $1,222,350,000, or 45 per cent less than 1920 production. The average wholesale price of motor cars in 1921 was $702, against an average of $897 the previous year. The average wholesale price of motor trucks in 1921 was $968, against an average for 1920 of $1,273.

December shipments, partially estimated by the National Automobile Chamber of Commerce show increase over the previous year of 5 per cent, but a decrease of 19 per cent compared with the previous month. Tabulation of factory shipments for the last two years follows:

	Carloads		Driveaways		Boat	
	1921	1920	1921	1920	1921	1920
January	6,485	25,057	3,185	29,283	93	.....
February	9,986	25,505	7,507	43,719	99	.....
March	16,287	29,326	9,939	55,273	75	.....
April	20,187	17,147	14,197	64,634	1,619	.....
May	18,608	21,977	15,193	74,286	2,381	.....
June	20,269	22,516	18,834	60,746	3,947	8,350
July	19,514	23,082	15,533	52,342	3,726	8,702
August	20,758	23,386	15,218	34,060	3,595	7,095
September	19,002	20,804	13,840	24,431	2,959	5,469
October	17,717	17,209	12,926	14,127	2,214	2,519
November	14,240	13,253	10,505	9,497	1,402	659
December	*12,100	11,802	*7,500	6,469	134	89
Total	195,153	251,064	144,377	470,867	22,244	32,883

*December 1921 partly estimated.

Welding Society Issues Monthly Bulletin

The first issue of the *Proceedings of the American Welding Society* appeared last month. The journal is made up of forty-five pages of interesting reading matter for welding engineers and others engaged in welding processes. The proceedings of the society, its committees and sections in all parts of the country are given in full. Technical papers on welding operations are printed, as well as news items and personal notes.

The journal is published in New York City, at the headquarters of the society, 33 West 39th Street.

Business Items

The Chillingworth Engineering Corporation has opened offices at 143 Liberty St., New York City. Frank H. Plum, Herbert Pluemer, G. E. Mellin and H. Von Shaden, formerly of the C. W. Hunt Engineering Corporation, have associated themselves with the Chillingworth organization, which will engage in the manufacture of conveyors and hoisting machinery.

The Philadelphia office of the Hauck Manufacturing Co., manufacturer of portable oil burners, furnaces, etc., has been moved to 1726 Sansom St. Herbert Vogelsang is in charge.

The Colonial Metal Products Co. has been organized at Syracuse, N. Y., as a consolidation of the Colonial Machine Co. and the Syracuse Metal Products Co. The new company will manufacture tools and special machinery at its plant on Edison St. The following officers have been elected: E. A. Klein, president; first vice-president M. H. McCarthy; second vice-president, W. F. O'Donnell; treasurer, J. F. Moran; secretary, D. O. Macken. Other directors are A. Vandecar, J. Barrett and Alexander Meldrum.

The plant of the Syracuse Twist Drill Co., at Syracuse, N. Y., was almost destroyed by fire on Feb. 1. Machinery and stocks of tools were damaged, the loss being estimated at about $20,000.

The new plant of the Kelsey Motor Co., at Newark, N. J., was opened on Feb. 6. A production of five to six thousand Kelsey friction-drive cars is expected the first year. E. B. Slade is president; C. W. Kelsey, who perfected the friction-drive, is general manager.

At the annual meeting of the Sheet Metal Employers Association, Cleveland, Ohio, the following officers were elected: President, F. B. Hiller; vice-president, W. F. Seiten; secretary, J. M. Saunders; treasurer, W. J. Birmingham. The board of trustees includes George F. Thesmacher, O. A. Mannen and William Barger.

The Wright & Querie Manufacturing Co., Meriden, Conn., has recently been organized and incorporated under the laws of Connecticut to manufacture and sell machine and wood screws, hardware, etc. The capital is $10,000. The incorporators are H. H. Wright, 909 North Colony St., Meriden; O. J. Querie, Meriden; and C. W. Wright, New Bedford, Mass.

Edmund S. Wolfe, president of the First National Bank, Bridgeport, and Col. Elmer H. Havens, president of the company, have been appointed receivers of the Locomobile Company of America, Bridgeport, Conn., automobile manufacturers, by Judge Edwin S. Thomas of the United States District Court. Col. Havens states that the move is a mutual step toward the proper reorganization of the company on a sound financial basis. He also states the company is doing a very good business.

The W. F. Concannon Shear Co., 42 Depot St., Milford, Conn., has just been organized and incorporated with $20,000 capital stock, to engage in the manufacture of steel shears and scissors. W. F. Concannon, Bridgeport, is the president; and Edwin L. Oviatt, Milford, is the treasurer.

The Efficiency Auto-Engineering Co., Inc., Bridgeport, Conn., recently filed a certificate of incorporation under the laws of Connecticut, to manufacture and sell metal goods and machinery. The capital stock will be $50,000. The incorporators are: Jesse B. Woodhull, 526 Water St., Myron E. Baker, Thomas Martin and Alexander L. Delaney, all of Bridgeport, Conn.

W. H. Turner was re-elected president of the Superior Machine and Tool Co., Kokomo, Ind., at the annual meeting of stockholders held recently. Other officers elected were: Charles H. Hummel, vice-president; A. B. Armstrong, treasurer; E. S. Moore, secretary. The board of directors elected comprises: A. B. Armstrong, E. S. Moore, G. W. Charles, W. H. Turner, C. L. Hummel, E. Simmons and S. Frank.

The Borg & Berg Co., manufacturers of steel explosive shells, with a plant at Davenport, Iowa, has reduced its capital stock from $5,000,000 to $1,500,000.

The Kihm-Bowen Machine Co., Irvington, N. J., has gone into the hands of a receiver. The attorney for the company states that a reorganization will take place and business will be resumed as soon as conditions permit.

The United States Hoffman Machinery Co. has been merged with the United States Hoffman Machinery Corporation, under the latter name. The company's factory has been moved from Syracuse, N. Y., to 105 Fourth Ave., New York City. The combined capitalization is stated to be $11,250,000.

The Superior Roller Bearing Co., Canton, Ohio, has been absorbed by the Vervoort Ball Bearing Co., Cleveland, Ohio. The former company was owned by H. G. Tremmel and H. C. Boester. Operations are being carried on in the Cleveland plant, and there is sufficient business to keep the plant going for the next six months, according to Mr. Tremmel who is secretary and general manager. The company is building a new factory in the east end of Cleveland, which it expects to occupy next spring.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

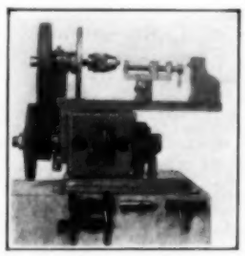
Jig, Drilling, Automatic, Caulkins.
E. L. Krag & Co., 50 W. Randolph St., Chicago, Ill.
"American Machinist," September 22, 1921.

The device is intended for mounting on the table of a sensitive drilling machine employed on parts made in large quantities. Its purpose is to leave the hands free to manipulate the work that is being put into the machine, the operator controlling the clamping, drilling and discharging of the piece by a pedal. The clamping of the work and the tripping of the feed are done automatically. An automatic lubrication system can also be supplied.

Reclaiming Outfit, Oil.
S. F. Bowser & Co., Inc., Fort Wayne, Ind.
"American Machinist," September 22, 1921.

The apparatus can be adapted to the reclaiming of different sorts of lubricating oils, but it is especially intended for use on oils employed in internal-combustion engines. It is said to restore the oil to its original condition as to viscosity, flashpoint and purity. The reclaimer is ordinarily manufactured in two sizes, one having a capacity of 50 and the other of 100 gal. per 24 hours. The reclaimer proper is the large tank shown at the center. The two rectangular tanks at the right are for the clean oil and dirty oil, respectively. The apparatus at the left is a still and condenser, which takes care of the fumes.

Lathe, "Utility."
Electric Motor Manufacturing Co., Ludington, Mich.
"American Machinist," September 22, 1921.

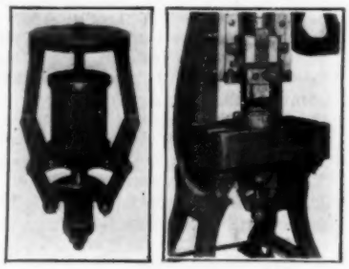


This outfit is for use where a small machining unit is required. It consists of a lathe, drill press, and grinding wheel, all driven by one electric motor, and intended for bench use. The grinding wheel is mounted directly on the motor shaft, and the spindle of the lathe is driven through covered gears. The position of the tail-stock is adjustable, and work 12 in. long and 4 in. in diameter can be handled. The motor can be furnished either for 32-volt., d.c. or 110-volt, a.c. circuits. Where only a grinder is required, the motor with an abrasive wheel and toolrest can be supplied.

Inclinometer
Young-Fischer Co., Milwaukee, Wis.
"American Machinist," September 22, 1921.

This instrument is intended to take the place of the plumb, level, or protractor in mechanical laboratories and machine shops where angles are to be determined, and especially where accuracy is required. It consists of a machined case of cast metal containing a gear train driven by gravity impulse. The hand on the degree dial moves in unison with the impulse, while the hand of the minute dial makes 36 rev. while the degree hand is making one. For the accurate inspection of angles it is claimed to be superior to the sine-bar, as no calculations are necessary.

Attachment, Combination Die, Spring Pressure.
E. W. Bliss Co., Brooklyn, N. Y.
"American Machinist," September 22, 1921

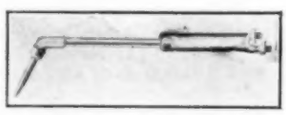


This attachment is for use on small punch presses equipped with combination dies, being shown on the right of the illustration mounted on the No. 20 press. A toggle motion is used to give a uniform pressure on the blank during the entire draw, thus reducing the total rubber or spring compression. The attachment is regularly made in four sizes, the depth of the draw obtainable varying from 1¼ to 2½ in. The attachment does not interfere with the operator, and the dies can be easily removed.

Elevator, Portable, "Little Lifter."
Economy Engineering Co., 2635 W. Van Buren St., Chicago, Ill.
"American Machinist," September 22, 1921.

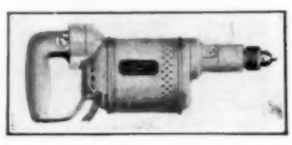
The elevator is intended for lifting and tiering materials, and is operated by an electric motor, deriving current from the ordinary 660-watt lighting socket. The speed of the platform varies from 7 ft. per minute in the 1,000-lb. capacity machine to 12 ft. per minute for the 500-lb. capacity machine. The hand crank can be used when desired. An automatic adjustable stop for the platform and a hand brake for holding the load at any point are provided.

Torch, Oxy-Acetylene, "Cut-Weld"
Alexander Milburn Co., 1420 W. Baltimore St., Baltimore, Md.
"American Machinist," September 22, 1921.



The chief feature of the torch is in the design of the tip, which is so constructed as to give a triplicate means of mixing the oxygen and acetylene. The torch is 19 in. long and provided with three welding and three cutting tips. A tip can be furnished for cutting steel 18 in. thick. The torch is made of brass and all parts are accessible. The method of seating the tip is said to prevent breakage, as well as splitting and cracking of the tip and head. The tip is placed at an angle of 60 deg. to the torch, and is made of bronze having a high copper content. The change from welding to cutting can be made by merely changing the tip.

Drill, Portable, Electric.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
"American Machinist," September 22, 1921.



The drill has a pistol grip and is light, high-speed, and has a capacity of ⅜ in. It is especially adapted for work on automobile bodies and in car building. The drill is equipped with a universal motor, for use on direct and alternating current of the same voltage. The motor housing, end caps and handle are made of aluminum. The armature and gear studs are mounted on ball bearings. The switch is of the quick make-and-break type, and is entirely enclosed in the handle and operated by a button.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

LOUIS ILLMER of Lansdowne, Pa., who for some time has been engaged in private practice as oil engine expert and also in marketing his patented impulsion fuel pump, has been retained by the Brown-Ferrier Co., Philadelphia, as consulting engineer in connection with the further development of fuel pump work.

E. E. CREED, of the general sales department of the Gilbert & Barker Manufacturing Co., Springfield, Mass., has recently been assigned to the San Francisco office of the company, to have charge of the Western field.

GEORGE W. CRAVENS, formerly with the General Electric Co., American Motors Co. and the Elkhart Motor Car Co., has been elected president of the Climax Engineering Co., Clinton, Iowa. Other officers elected were: C. B. Stebbins, vice-president; R. D. Upton, treasurer; J. M. Thomsen, secretary. G. W. Dulany Jr. is chairman of the board of directors.

WILLIAM F. PARISH has established himself in the Peoples Gas Bldg., Chicago, Ill., as a consulting lubrication engineer. He will conduct a petroleum analytical and experimental laboratory.

W. H. SACKMAN has resigned as chief engineer of the Light Manufacturing and Foundry Co., Pottstown, Pa.

ALFRED C. RANTSCH has been appointed sales manager of the Eastern territory for the Soss Manufacturing Co., Brooklyn, N. Y., manufacturers of castings and alloys. Mr. Rantsch was formerly connected with the Doehler Die Casting Co.

FRED W. RAMSEY has resigned as president of the Cleveland Metal Products Co., Cleveland, Ohio. Mr. Ramsey will devote his entire time to civic and philanthropic activities in Cleveland, where he is prominently identified with social and community affairs. He will become a director of the company and will retain an office at the plant. He has been succeeded as president by L. S. Chadwick, chief engineer of the company.

Obituary

CHARLES LEWIS TAYLOR, prominent Pittsburgh steel operator and president of the Carnegie Hero Fund Commission, died at his winter home in Santa Barbara, Cal., on Feb. 3. He was sixty-five years old.

GEORGE A. OHL, SR., veteran machinery manufacturer of East Orange, N. J., died at his home in that city on Feb. 8. Mr. Ohl was the holder of fifty-two patents on his own inventions of machinery. He was eighty-five years old.

HUBERT P. RICHARDS, for many years connected with the Stanley Rule and Level Co., New Britain, Conn., in the capacity of machine designer and engineer, and in earlier life associated with Sterling Elliot at Newton, Mass., died at his home in New Britain, Conn., on Jan. 29. He was sixty-nine years old. Mr. Richards was a brother of Francis Richards, the well-known inventor of New York City.

Book Reviews

A Life of George Westinghouse. By Henry G. Prout, C. E., A. M., Ll. D. For a committee of the American Society of Mechanical Engineers. 375 pp., 6 x 9 in. Illustrated. Published by Charles Scribner's Sons. New York. Price $2.50.

"And there were giants in those days." And in our day as well, and one of the greatest was George Westinghouse. His name is known over the civilized world, but to most of us for only one or two of the many big things he accomplished. Some men knew of him through his work in the field of electricity, others for his development of the air brake and the friction draft gear, still others for his exploitation of natural gas, but few have any conception of the many and varied practically successful inventions which stand to his credit and which have contributed so much to the advancement of civilization. It seems almost inconceivable that any one man could take out four hundred patents even in forty-eight years, and average of one patent every month and a half of his working life. His first patent was granted when he was nineteen and he was still inventing when death overtook him. The noteworthy characteristic of these many inventions was that no one of them was evolved to sell or as a speculation, each was calculated to meet a practical situation encountered in his own work.

The book is so arranged that a chapter is given over to each of the major branches in which George Westinghouse made his influence felt, one to the air brake, one to the friction draft gear, one to the rotary converter, etc. The material for each technical chapter was prepared by some expert who was close to Westinghouse and could speak authoritatively on the subject, and the whole was gathered together by Col. Prout and digested and edited to make a homogeneous whole. These chapters are interesting in the complete picture they give of the genius of the man for effective work in widely different fields, but it is likely that the concluding chapters on the "Personality of George Westinghouse" and the "Meaning of George Westinghouse" will be the most fascinating even to the engineering reader.

In these chapters the wonderful character of a really great man is described. His interest in his men his tremendous driving power which swept away all obstacles, his steady cheerfulness in the face of adversity and disappointment shine forth as an inspiration to every one of us. His powers of concentration, his mechanical genius and his energy are given to few men, but his high character is an example which can be emulated by anyone.

The thanks of the engineering profession are due the committee of the mechanical engineers under whose direction the book was prepared, but the greatest credit should go to Col. Prout who brought to his task an intimate acquaintance with Mr. Westinghouse and the artistic skill of his many years as editor of the *Railway Gazette*. The members of the committee were Charles A. Terry, chairman; Paul D. Cravath, Alexander C. Humphries, James H. McGraw, Charles F. Scott, Lewis B. Stillwell and Ambrose Swasey, with Henry Herman Westinghouse always in consultation.

Essentials of Industrial Costing. By George S. Armstrong, consulting industrial engineer, A.S.M.S and A.S.C.E. Dark red cloth-board covers, 6 x 9 in., 297 pages, 80 illustrations. Published by D. Appleton and Co., New York, N. Y. Price $5.

The volume treats in a very concise and comprehensive manner the finding of the cost of production. It should serve as an aid to industrial administration, as the text is concerned solely with the principles and methods by which the cost of production may be derived. Being based on experiences in many and diverse industries, the practical side is never lost sight of nor considered secondary to theory. Most of the theory in the book is presented on the clinic or case system, so as to prevent speculative discussion on concrete issues. In developing the theory, suggestions are given to apply to exigencies that may arise. The book stays very close to essential principles, not being concerned with irrelevant matters or theory not related closely to the problem. It is concise in style and well organized, with each aspect of the subject treated so as to give a balanced whole. After the theory of the system has been developed, a complete working model of a cost system is given, its purpose being to show the mechanism of costing and to serve as a guide in the preparation of similar systems.

In order to give an idea of the scope of the volume, the list of chapter headings is herewith given: Economic Development and Necessity of Costing; The Purpose and Function of Costing; The Mechanism of Costing; Elements of Costing and Sources of Costing Data; The Costing of Material; The Costing of Labor; The Collection of Expense in Costing; The Costing of Depreciation, Interest and Power; The Distribution and Application of Expense in Costing; Final Costing; The Connection of Costing with the General Books and the Preparation of Monthly Statements Therefrom.

Pamphlets Received

Heat-Treatment of Springs with Stationary and Continuous Furnaces: W. S. Rockwell Co., 50 Church St., New York City. A technical treatise on the fundamental principles of heating and handling springs, with illustrations of these principles as applied to the manufacture of a variety of springs. It is intended to show a method of improving the quality and decreasing the cost of the product.

Metal Polishing: The Norton Company, Worcester, Mass. A thirty-page booklet containing some valuable information on metal polishing with alundum abrasive. Interesting comparisons with other methods are shown.

Trade Catalogs

Hydraulic Valves and Fittings. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Catalog No. 43-B, sixty-five pages, finely bound and engraved, describing a complete line of H-P-M high pressure valves and fittings. The pages are profusely illustrated, each type being shown in detail, together with operating charts and specifications.

Abrasive Discs. Gardner Machine Co., Beloit, Wis. A sixteen-page booklet containing complete instructions on the proper setting and handling of abrasive disks. Another circular treats of the heavy abrasive disk made by the same company.

Air Compressors. Pennsylvania Pump and Compressor Co., Easton, Pa. Bulletin No. 102, describing a line of single stage, straight line air compressors and vacuum pumps, in both the belt and steam-driven types. The special features of Pennsylvania machines are described.

Eck Motors. Eck Dynamo and Motor Co., Belleville, N. J. A series of four bulletins, Nos. 1300, 1500, 1600 and 1900. They cover a comprehensive line of direct current vertical, back-geared and polyphase induction motors. Each type is fully illustrated and described.

Rockford Tools. Rockford Milling Machine Co., Rockford, Ill. A ten-page circular describing and illustrating a line of cutters, arbors, collets and small tools for use with Rockford milling machines.

Waterhouse Pistons. Waterhouse Welding Co., 15 Pelham St., Boston, 18, Mass. A sixty-five page booklet giving specifications and prices of a line of pistons, piston-pins and rings for pleasure cars, trucks, motorcycles and motors.

Saw-Sharpening Tools. The Wardwell Manufacturing Co., Cleveland, Ohio. A twenty-page catalog illustrating and describing a comprehensive line of saw filing and grinding machines.

Forthcoming Meetings

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

American Society for Steel Treating: Sectional meeting, New York City, Mar. 3, Hotel McAlpin, 34th St. & Broadway. W. H. Eiseman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Metal, Light, "Magna-Metal"

Magna Metal Corporation, 227 High St., Newark, N. J.

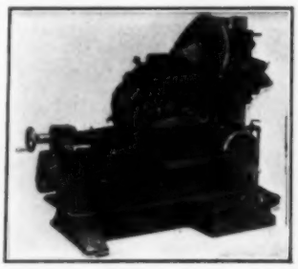
"American Machinist," Sept. 22, 1921.

The metal is for mechanical purposes where strength and lightness are essential. The base is metallic magnesium, which forms over 90 per cent of the alloy. It can be used as castings and forgings, or it can be rolled. The specific gravity is given as 1,742 and the weight per cubic foot as 108.8 lb. The tensile strength is 19,300 lb. for castings; 27,600 lb. for rolled; and 31,900 lb. for forgings. The metal can be machined without lubricant, and leaves a clean cut surface in threading and similar operations.

Grinding Machine, Gear, Generating, No. 10

Lees-Bradner Co., Cleveland, Ohio.

"American Machinist," Sept. 29, 1921

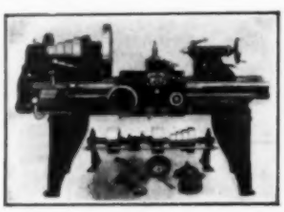


The machine is intended for grinding the faces of involute spur-gear teeth, being capable of working on gears having pressure angles of from 14½ to 24 deg., diametral pitches from 12 to 3, and pitch diameters from 2 to 12 in. The abrasive wheel used is 30 in. in diameter, being supported on a stationary column, and the work traversed past it on a slide having a reciprocating action. Besides the linear motion, the work is given the correct rotary motion, so as to obtain the desired profile on the tooth face. In this way the tooth surface is generated. The work can be held between centers, or supported on a mandrel having a taper shank to fit the spindle.

Lathe, Geared, Quick-Change

South Bend Lathe Works, South Bend, Ind.

"American Machinist," Sept. 29, 1921



The machine is similar in general construction to the plain type of change-gear lathe made previously by the concern. The feed box that has been added is of the type used on the Flather lathe. Forty-eight changes of feeds and threads are provided, these changes applying also to the cross-feed. The lathe is made in sizes of 9, 11, 13, 15, 16, 18, 21 and 24 in., with either straight or gap bed. All of the feeds are controlled from the front of the apron, and are so interlocked that only one feed can be engaged at a time.

Milling Machine, Vertical-Spindle, Nos. 5-A and 6-A

Jackson Machine Tool Co., Jackson, Mich.

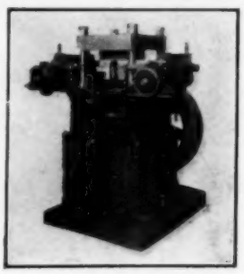
"American Machinist," Sept. 29, 1921

The machine is made for such work as on drop-forging dies where a cherrying operation is not required. The spindle has a vertical movement manipulated by hand through a mechanism which permits of both slow feed and rapid traverse. The weight of the spindle and housing is counterbalanced. The machine is made either with or without power table feed. The spindle has speeds of 200, 325 and 520 r.p.m. The table is 13 x 40 in. on the No. 5-A machine, and 13 x 48 in. on the No. 6-A machine, the longitudinal travels being 32 and 40 in., respectively.

Dieing Machine, Sheet-Metal

Henry & Wright Manufacturing Co., Hartford, Conn.

"American Machinist," Sept. 29, 1921.



This machine is intended for piercing, blanking, forming and stamping sheet-metal. It embodies a departure from the usual punch-press construction, the mechanism being inverted. The heavy fly-wheel is placed on the back side near the floor, and the moving parts except the tools themselves are enclosed within a cabinet base. The crankshaft passes transversely through the base at the junction of the upper and lower sections, so that the crankshaft with all attached working parts may be removed. The machine is made in three sizes, 10, 25 and 50 ton capacity. The largest machine stands 64 in. high and occupies a floor space approximately 5 ft. square. It weighs 5,400 pounds.

Punch Press, Adjustable-Bed

Ferracute Machine Co., Bridgeton, N. J.

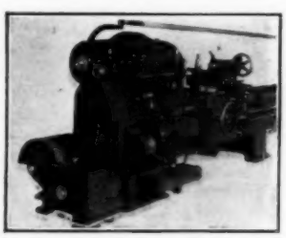
"American Machinist," Sept. 29, 1921

The press is for work requiring a long stroke and unusual height between the bed and ram. The bed has a vertical adjustment, by means of which the distance between the bed and the ram may be varied. The connection between the bed and frame is made by heavy bolts, and the 4-in. adjusting screw supports the bed solidly. The ram has 3 in. adjustment, and the bed 9 in. A maximum distance of 30 in. is given between the bed and the ram. The stroke of the ram is 8 in. The press exerts a pressure of 70 tons and weighs 13,200 pounds.

Lathe, Geared-Head, Quick-Change

Bradford Machine Tool Co., 8th and Evans Sts., Cincinnati, Ohio.

"American Machinist," Sept. 29, 1921

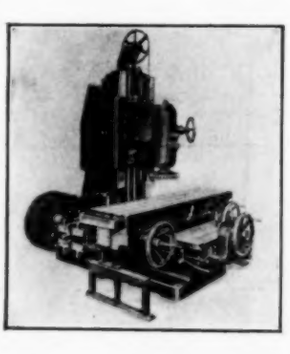


The machine is very similar in general characteristics to one formerly made by the concern, the principal difference being in the use of the double back-gears. The lathe is made in swings of 26, 28, 30 and 32 in. It is intended for either single-pulley or direct motor drive. A locking arrangement permits of shifting the gears only when they are free from the driving action. Eighteen speeds are provided, varying from 6.7 to 282.5 r.p.m. The back-gear ratios are 12.57 to 1, and 3.55 to 1. By means of the two shifting levers, 16 changes of feed are provided without the changing of any removable gears.

Milling Machine, Vertical-Spindle, No. 10

Jackson Machine Tool Co., Jackson, Mich.

"American Machinist," Sept. 29, 1921



The machine is intended for production work on die-sinking, the head carrying a heavy vertical spindle. The No. 10-A machine has table and cross-rail feeds ranging from 0.001 to 0.015 in. per revolution of the spindle, while the No. 10-B machine has a range of feeds from $\frac{1}{16}$ to 6 in. per minute, regardless of the speed of the spindle. Inside of the head, gears provide thirteen changes of spindle speed ranging from 8½ to 310 r.p.m. A circular table 36 in. in diameter may be provided for circular and continuous milling. The head has a vertical movement of 24 in. The driving pulley runs at 300 r.p.m., a 10 to 15-hp. motor being required.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Fla., Sumica—The Florinda Mill & Planing Co., W. J. Fink, Mgr.—planers, saws, matchers, etc.

Ill., Chicago—The Atchinson, Topeka & Santa Fe R.R., 80 East Jackson Blvd., M. J. Collins, Purch. Agt.—one 10 ft. gate shear with 20 in. stroke, capacity to cut ⅜ in. metal, motor driven, 230 volts; 3 motor driven internal and external tool post grinders.

Ill., Chicago—The Arctic Cabinet Co., 2237 Archer Ave., E. Bourdon, Purch. Agt.—square shears 48 in. or larger, (used).

Ill., Chicago—The Chicago Casket Co., 7029 Stony Island Ave.—One 20 in. drill press; one No. 1 stamping press; portable Fairbanks platform scales.

Ill., Chicago—The Glass Novelty Co., 1919 West 19th St.—one self feeding rip saw and two 6 in. stickers.

Ill., Chicago—E. Hooson, 6247 South St. Louis Ave.—one bench lathe, one polishing lathe and one 36 in. foot power square shear and blower for small furnace.

Ill., Chicago—Johnson & Horner, 1347 Belmont Ave., A. Horner, Purch. Agt.—one No. 5 back geared press, 4 in. stroke, or screw press 12 in. stroke.

Ill., Chicago—Leitelt Bros., 7731 South Chicago Ave.—one 72 in. double crank press suitable for 20 gauge sheet metal.

Ill., Chicago—The Monarch Tool & Machine Co., 522 South Clinton St.—one 10 K. W. Taylor spot welder.

Ill., Chicago—A. D. White Mchy. Co., 108 North Jefferson St., A. P. White, Purch. Agt.—one No. 5 geared back press, 4 in. stroke.

Ill., Galesburg—The Rowe Mfg. Co., Holton and West 3rd Sts.—geared punch press, 50 to 100 ton capacity (used).

Ill., St. Charles—The Faultless Iron Wks.—one power press, 8 ft. for 2 breaks of 18 gauge soft steel, similar to Ohl geared press, (used); one power squaring shear, 8 ft. for 16 gauge steel; one electric spot welder with adjustable lower arm and 24 in. reach or more.

Mich., Ferndale—A. O. Le Grande, 393 Woodland Ave.—sheet metal working machinery (used).

Miss., Gulfport — The Mississippi Cane Syrup Co., A. L. Byrd, Purch. Agt.—cold storage plant sufficient in size to freeze about 10 ton of ice per day and to cool a room about 50 ft. sq.

Mo., North Kansas City (Kansas City P. O.)—The Standard Steel Wks., 1722 Tracy St.—one air compressor, capacity four riveting hammers (used).

Neb., Imperial—The Bd. Educ., J. Burke Pres.—equipment for manual training and domestic science departments of high school.

N. J., Trenton—The Trenton Rough Dry Laundry, 927 East State St.—machinery for proposed laundry on East State St.

N. Y., Kingston—Terry Bros., North St.—small standard gage bucket and operating locomotive crane.

N. Y., New York—Kleinert & Sons, 920 Brook Ave.—one punch press and screw machine.

N. C., Hamlet—J. C. Brittingham—machinery for knitting mill.

N. C., Magnolia—R. D. Carr—shingle mill machinery.

O., Cincinnati—The Clifton-Pratt Co., 1224 West 8th St., A. B. Clifton, Purch Agt.—four tumbling mills for foundry, 20 or 36 in. with or without exhaust. (used); one 36 in. or 42 in. cupola, 5 or 7 ton per hour; one sand blast outfit, New Haven or equal.

O., Cincinnati—The Jones Machine Tool Co., 435 East Pearl St., S. L. Jones, Purch. Agt.—one 1½ in. and one 2 in. bolt cutter, Atlee, National or Landis; one double crank geared press, 40 ton capacity, similar to Bliss No. 2½; one small quick change lathe, 14 on 16 in.; one No. 12 Barber Coleman gear hubber.

O., Cleveland—A. C. Bishop & Co., 426 Guardian Bldg.—complete line of machinery for ice plant of the Mutual Ice Co., Erie, Pa.

O., Columbus—The city Ice Supply & Coal Co., 38 Mithoff St.—$65,000 worth of machinery and equipment for proposed ice plant on 22nd St.

Pa., Brackenridge—The West Penn Steel Co.—two keyseating machines.

Pa., Pittsburgh—The American Bridge Co., Frick Bldg.—one 24 in. shaper.

Pa., Pittsburgh — H. R. Eicher, House Bldg.—one 10 ton locomotive crane traction or standard gage with 30 ft. boom and ¾ yd. clam shell bucket.

Pa., Washington—G. Kestrick, 988 Bruce St.—lathe, drill press and shaper.

Tenn., Knoxville—The Keller Fdry., Willow St.—one 20 in. drill press and band saw.

Va., Boone Mill—The Boone Mill Mfg. Co., J. Garet, Pres.—will receive bids until May 1 for planing mill machinery, engine and boiler for woodworking plant, dry kiln equipment and barrel heading machinery (used-rebuilt).

Va., Denbigh—J. W. Hoopes & Co., manufacturer of chemicals, J. W. Hoopes, Pres.—powder mixing machine; powder sifter machine; tablet machine; emulsifier; liquid and paste filling machine (new or used).

Va., Norfolk—The Sykes Bros. Lumber Co., 45th St. and Colley Ave., W. W. Sykes, Purch. Agt.—combination wood working machine with rip saw and jointer combined. (used).

Va., Radford—F. L. Foster—small lathe, grinder, small air compressor and miscellaneous garage equipment and small tools (new or used).

W. Va., Harrisville—The Bd. Educ., S. O. Prunty, Pres.—equipment for vocational department of new school.

W. Va., Logan — The Guyan Machine Shops—gear cutter for spur and bevel gear up to 30 in. in diameter; electric furnace for melting brass; shear and punch for ½ in. plate.

Wis., Madison—The Harcum Fuel Co., 35 West 1st St., C. R. Burnton, Pres.—elevating and conveying machinery for fuel storage plant.

Wis., Manitowoc—The Republic Chemical Co., E. H. Koehneke, Pres.—machinery and equipment for new chemical plant also laboratory equipment.

Ont., St. Thomas—The Council, A. Curtis, Chn.—two vertical retorts, coal and coke handling equipment, etc., for civic gas plant.

Metal Working Shops

Cal., San Bernardina — The Atchinson, Topeka & Santa Fe Ry., Kerckoff Bldg., Los Angeles, has awarded the contract for the construction of a 1 story, 65 x 510 ft. addition to its machine shop, here. Estimated cost, $250,000. Noted Jan. 26.

Cal., Stockton—H. S. Dawson, 630 California St., is having preliminary plans prepared for the construction of a 1 story garage on Oak St. between California and American Sts. Estimated cost, $45,000. G. Allen, 37 South Aurora St., Archt.

Conn., Hartford—J. Reibert, Mountain Rd., West Hartford, has awarded the contract for the construction of a 1 story, 52 x 220 ft. garage and repair shop on Park St., here. Estimated cost, $50,000. Noted Jan. 26.

Conn., Springdale—(Stamford P. O.)—The Segal Lock Co. has awarded the contract for the construction of a 1 story, 40 x 85 ft. factory for the manufacture of locks and hardware.

Ill., Chicago—O. Van Gunter, Archt., 800 North Clark St., is receiving bids for the construction of a 2 story, 42 x 82 ft. auto repair shop on Clark and Howard Sts., for R. Johnstone, care of architect. Estimated cost, $20,000.

Ill., Morris—The Chicago, Rock Island & Pacific R.R., La Salle St. Sta., Chicago, is having plans prepared for the construction of 1 story car shops, here. Estimated cost, $50,000. Private plans.

Ill., Peoria—The Peoria Auto Parts Co., 817 South Adams St., has awarded the contract for the construction of a 2 story, 60 x 100 ft. garage and repair shop. Estimated cost, $120,000. Noted Feb. 9.

Ind., Bloomington — The Bloomington Nash Motor Co. has awarded the contract for the construction of a 2 story, 85 x 130 ft., service and repair works. Estimated cost $80,000.

Ind., Indianapolis—R. Miller, c/o City Trust Co., Market and Delaware Sts., is having plans prepared for the construciton of a 5 story, automobile service and repair plant on Illinois St. Estimated cost $750,000. Bass, Knowlton & Co., 801 Hume-Mansur Bldg., Archts.

Kan., Columbus—The Baldwin Garage Co. is having plans prepared for the construction of a 1 story, 120 x 156 ft. garage. Estimated cost, $50,000. Private plans.

Kan., Wichita—W. P. Innes, 1112 Lawrence Ave., has awarded the contract for the construction of a 1 story, 85 x 147 ft. garage on Douglas and Indiana Sts. Estimated cost, $50,000. Noted Jan. 26.

Mo., Jefferson City—W. B. Haarstick and R. Knox, Vandalia, plans to build a 2 story auto chain factory. Estimated cost, $70,000. Architect not selected.

Mo., St. Louis—D. F. McCabe, 6407 Ridge Ave., is having plans prepared for the construction of a 1 story, 75 x 95 ft. garage. Estimated cost, $40,000. Bonsack & Pearce, Laclede Gas Bldg., Archts.

Neb., Lincoln—The Bd. Educ. plans to build a 1 story high school shop. Estimated cost, $125,000. Fiske & Meginnis, 533 Bankers Life Bldg., Engrs.

The Weekly Price Guide

THIS WEEK'S MARKET

REDUCTIONS averaging $1@$2 per gross ton on pig iron quoted in the principal markets. Soft steel bars quoted at $1.40@$1.50, Pittsburgh; shapes and plates at $1.40 for large tonnages and $1.50 per 100 lb. for smaller lots. Mill shipments, New York, of structural shapes, plates and bars are quoted at $1.78@$1.88 per 100 lb.

Electrolytic copper is quoted in New York warehouses at 14c. as against 14¼c.; tin reduced to 32c. from 32½c. and spelter at 5¼c. as compared with last week's quotation of 5⅛c. per lb. Little interest in copper is shown on the part of the consumer but lead market shows considerable firmness. Tin somewhat weaker. Babbitt metal, best grade, quoted at 32c. as against 31c. and commercial grade at 16½c. as compared with 16c. per lb. one week ago.

Linseed oil, raw, quoted in New York at 83c. as against 79c. per gal. in 5 bbl lots.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$20.50
Northern Basic	21.02
Southern Ohio No. 2	22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	26.26
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	21.76
Virginia No. 2	27.74
Basic	19.84
Grey Forge	21.50
CHICAGO	
No. 2 Foundry local	19.70
No. 2 Foundry, Southern, sil 2.25@2.75	22.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	19.96
Bessemer	21.46

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	⅜ to 1¼	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1¼	69	57½	⅜ to 1¼	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods(base)	7.00	8.00	6.03
Hoop steel	3.38	2.96	3.13
Cold rolled strip steel	6.25	8.25	6.50
Floor plates	4.60	4.56	3.40
Cold finished shafting or screw	3.45	3.25	3.40
Cold finished flats, squares	3.95	3.75	3.90
Structural shapes (base)	2.63	2.46	2.63
Soft steel bars (base)	2.53	2.36	2.53
Soft steel bar shapes (base)	2.53	2.36	2.53
Soft steel bands (base)	3.13	....	3.13
Tank plates (base)	2.63	2.46	2.63
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/16	8.50		12@13
⅛	7.15		11@12
5/32 to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.00
Tin, 5-ton lots, New York	32.00
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.77½; New York	5.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.50	6.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (carlots)	15@15.25	17.00	16.25
Copper rods (ton lots)	19.75	24.00	19.50
Copper tubing (100-lb lots)	21.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	17.00	18.75
Brass tubing (100-lb. lots)	18.50	19.50	20.50
Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Zinc sheets (casks), (8% dis. carlots)	10.50	9.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.00	23.50	19.25
Babbitt metal (best grade)	32.00	41.00	36.00
Babbitt metal (commercial)	16.50	13.50	9.00

—Shop Materials and Supplies

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.00	11.00	11.00
Copper, heavy, and wire	10.75	10.50	10.00
Copper, light, and bottoms	8.75	9.00	8.75
Lead, heavy	3.75	3.50	3.50
Lead, tea	2.75	2.75	3.00
Brass, heavy	5.75	6.00	6.50
Brass, light	4.25	4.25	5.00
No. 1 yellow brass turnings	5.50	5.00	5.75
Zinc	2.75	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	22.50	21.00	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	12.00	14.50
IC, 112 sheets	12.80	12.30	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7.25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.13
Cotton waste, mixed, per lb	.055@.09	.09	.11
Wiping cloths per M., 13¼x13¼	.....	50.00	55.00
Wiping cloths per M., 13¼x20¾	.....	55.00	65.00
Sal soda, 100 lbs	2.10	2.50	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.83	.80	.84
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$2.75@$3.00	
Coke, prompt foundry, Connellsville	per net ton	3.75@ 4.25	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	60-5%	60-10%	60-10-10%
1¼ and 1¼x3 in. up to 12 in.	50%	60-10-10%	60-10%
With cold punched sq. nuts	50%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	55%	.....	$4.00 off
Button head bolts, with hex. nuts	35%	$3.90 net	.....
Hex. head and hex. nut bolts	40%	.....	65-5%
Lag screws, coach screws	65%	.....	60%
Carriage bolts, up to 1 in. x 30 in.	50-10%	60-10%	50-5%
Bolt ends, with hot pressed nuts	60%	.....	55%
Tap bolts, hex. heads	25%	.....	.....
Semi-finished nuts ⅝ and larger	75%	75-10%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	3.75	3.50	3 50
Washers, round plate, per 100 lb. Off list	4.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.00	3.50	4.00
Square and hex., head cap screws	75—10%	....	.....
Rivets:			
Rivets, 7/16 in. dia. and smaller	60-5%	60-10-10%	65-5%
Rivets, tinned	60-5%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	$3.25	$3.43
Cone heads, ditto (net)	3.60	3.35	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$4.03 base
Copper rivets	60-5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.85	$0.90
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50-5%	60-10%
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	35%	40%	40-5%
Rubber and duck:			
First grade	50-10%	50-10%	.....
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

N. J., Merchantsville—The Norton Mfg. Co. has awarded the contract for the construction of a 1 story, 60 x 175 ft. factory for the manufacture of metal products. Estimated cost, $15,000.

N. C., High Point—The Wilson Motor Co. plans to build a 3 story, 75 x 100 ft. addition to its garage. Estimated cost, $75,000. Architect not selected.

O., Cincinnati—The Federal Garage Co. has awarded the contract for the construction of a 5 story, 60 x 239 ft. garage at 417 Sycamore St. Estimated cost, $145,000.

O., Cleveland—The Winters Garage Co., 1381 West 117th St., is receiving bids for the construction of a 1 story, 42 x 100 ft. garage on West 117th St. near the Clifton Bldg. Estimated cost, $40,000. Private plans.

Pa., Butler—The Butler Buick Co., Main St., is having plans prepared for the construction of a 3 story, 85 x 110 ft. sales and service station. Estimated cost, $150,000. Hunting Davis Co., Century Bldg., Pittsburgh, Archts.

Pa., Carbondale—J. H. Paul has awarded the contract for the construction of a 1 story, 80 x 150 ft. garage. Estimated cost, $50,000.

Pa., Pittsburgh—The Martin Hardsogg Co., 922 South Ave., manufacturer of mill and mine supplies, is having plans prepared for improving present buildings and constructing top additions to various sections of plant. A. M. Trimble, Ferguson Bldg., Archt.

Pa., Summit Hill—J. Breslin has awarded the contract for the construction of a 2 story, 50 x 175 ft. garage. Estimated cost, $75,000.

R. I., Providence—Jenks & Ballou, Engrs., 10 Weybosset St., will receive bids about March 1, for the construction of a service station for the Narragansett Electric Lighting Co., Turks Head Bldg., including a 4 story, 42 x 154 ft. office building with 42 x 70 ft. wing, 3 story, 101 x 223 ft. light storage building and a 1 story, 120 x 223 ft. heavy storage building, a 1 and 2 story, 115 x 173 ft. garage, a 1 and 2 story, 45 x 56 ft. power plant, a 1 story, 28 x 93 ft. oil house with 17 x 22 ft. ell, 2 story, 10 x 17 ft. gate house, two 10 ton traveling cranes and three 1 ton cranes, etc.

R. I., Providence—The Textile Finishing Mchy. Co., 171 Westminister Ave., has awarded the contract for the construction of a 1 story, 200 x 250 ft. machine shop and a 2 story, 45 x 99 ft. office. Estimated cost, $225,000. Noted Dec. 15.

General Manufacturing

Cal., Los Angeles—The Angeles Furniture Co., 931 East Peco St., has awarded the contract for the construction of a 2 story, 123 x 138 ft. factory on Pico St. near Stanford St. Estimated cost, $50,000.

Cal., San Diego—The Bureau of Yards and Docks, Navy Dept., Wash., D. C., will soon award the contract for the construction of a refrigerating and cold storage plant here.

Conn., Boardman—The New England Lime Co., 226 Main St., Danbury, will build a lime plant here, to replace the one which was recently destroyed by fire. Estimated cost, $100,000. Noted Jan. 12.

Conn., New Haven—The Seamless Rubber Co., Inc., Hallock St., has awarded the contract for the construction of a 1 story, 140 x 160 ft. addition to its rubber plant. Estimated cost, $100,000. Noted Jan. 12.

Conn., South Norwalk—Harris & Gans, 70 Water St., are having plans prepared for the construction of a 2 story, 36 x 70 ft. wood plant on Water St. A. S. Meloy, 2965 Main St., Stratford, Archt.

Conn., South Norwalk—H. Jacobs & Sons, Day St., are receiving bids for the construction of a 2 story, 60 x 120 ft. addition to their shoe factory. Estimated cost, $65,000. A. S. Meloy, 2965 Main St., Stratford, Archt.

Del., Lewes—The Lewes Fertilizer Co. has awarded the contract for the construction of a fertilizer plant. Estimated cost, $65,000.

Fla., Sumica—The Florinda Mill & Planing Co. has had plans prepared for the construction of a new factory to replace the one which was recently destroyed by fire. W. J. Fink, Mgr.

Ill., Beardstown—The Gorman Ice & Coal Co. plans to build a 1 story, 30 x 42 ft. addition to its ice plant. Estimated cost, $25,000. Architect not selected.

Ill., Chicago—The Oetting Ice & Coal Co., 1725 West 15th St., has awarded the contract for the construction of a 1 and 2 story, 83 x 156 ft. ice factory at 1717-29 West 15th St. Estimated cost, $35,000.

Ill., Morrison—The Illinois Refrigerator Co. plans to build a 1 story addition to its refrigerator and furniture factory. Estimated cost, $40,000. Private plans.

Ill., Rockford—The Old Colony Chair Co., 1109 Seminary St., has awarded the contract for the construction of a 3 story, 65 x 68 ft. addition to its factory. Estimated cost, $35,000. L. Carlson, Secy.

Still Growing

Last July we published the names, addresses and requirements of 133 concerns in the market for

Machine Tools and Machinery

In November the number of these items had risen to 189 for the month.

In January, 1922, we published 248 machinery items, with an additional 202 items on the construction of new manufactories.

American Machinist

offers the best machinery market in America.

Are you using it to full advantage?

Ind., Ft. Wayne—The Craig Biscuit Co., 115 Montgomery St., plans to build a 4 story baking plant. Estimated cost, $150,000. McCormick Co., 41 Park Row, New York, Archts.

Ind., Michigan City — The Haskell & Barker Car Co. plans to biuld a 2 story paint shop. Estimated cost, $150,000. H. Shaw, 39 South State St., Chicago, Archt.

Ind., South Bend — The South Bend Brewing Co., 1702 Lincoln Way, is building 1 story, 90 x 90 ft., ice manufacturing plant. Estimated cost including equipment $60,000.

Minn., St. Paul—The Daily News Publishing Co., 94 East 4th St., will receive bids about March 1 for the construction of a 6 story, 75 x 135 ft. newspaper plant and office building on 4th St. between Cedar and Minnesota Sts. Estimated cost, $225,000. Toltz, King & Day, 1410 Pioneer Bldg., Engrs.

Mo., Jefferson City—The Standard Crate & Filler Co. is having plans prepared for the construction of a 2 story, 100 x 220 ft. crate and straw board factory. Estimated cost, $200,000. W. F. Winkleman, Treas. Private plans.

Mo., Leeds—The Wilson Slaughtering Device Co., 511 Amer. Bank Bldg., Kansas City, is having plans prepared for the construction of a 2 story, 30 x 140 ft. serum plant. Estimated cost, $50,000. Private plans.

N. J., Trenton—The Trenton Rough Dry Laundry, 927 East State St., is having plans prepared for the construction of a 2 story, 30 x 75 ft. laundry on East State St. Estimated cost, $10,000. J. O. Hunt, East Hanover St., Archt.

N. J., Union Hill (Weehawken P. O.)—The Pioneer Braid Mfg. Co., c/o A. Adelman, 429 6th Ave., New York, is receiving bids for the construction of a 2 story, 50 x 102 ft. factory on Park Ave. and Bloom St., here. G. Willaredt, 411 West 23rd St., New York, Archt.

N. Y., New York—The Fleischmann Co., 701 Washington St., will soon award the contract for the construction of a 3 story yeast laboratory on Mott Ave. Estimated cost, $200,000. A. B. Heaton, Maryland Bldg., Wash., D. C., Archt. and Engr.

O., Cleveland—J. Rosicka, 3726 East 71st St., has had plans prepared for the construction of a 1 story, 38 x 40 ft. paint shop at 3723 East 71st St. Estimated cost, $40,000. H. T. Jeffrey, 437 The Arcade, Archt.

O., Cleveland—The Ward Baking Co., c/o J. B. Arthur, East 143rd St. and Southern Blvd., New York, has had plans prepared for the construction of a 4 story baking plant on East 45th Pl. and Perkins Ave., here. Estimated cost, $300,000. C. B. Comstock, 110 West 40th St., New York, Archt.

O., Columbus—The City Ice Supply & Coal Co., 38 Mithoff St., is having plans prepared for the construction of an ice plant on 22nd St. Estimated cost, $35,000. Private plans.

Pa., Phila.—A. Eichhorn & Sons, Palethrop and Turner Sts., have awarded the contract for the construction of a 3 story, 80 x 82 ft. addition to their box factory on Hancock and Tuner Sts. Estimated cost, $14,000.

R. I., Woonsocket — The Lafayette Worsted Co., Hamlet Ave., will build a 3 story, 70 x 200 ft. addition to its mill.

Tenn., Johnson City—The Southern Refrigeration Co., Unika Bank Bldg., is having preliminary plans prepared for the construction of a 3 story, 100 x 100 ft. ice manufacturing and cold storage plant. Estimated cost including machinery $200,000.

Va., Danville — Register Publishing Co., 115 South Union St., is receiving bids for the construction of a 50 x 100 ft. printing plant and office building on Union and Patton Sts. Estimated cost, $55,000. Private plans.

Va., Kimballton—R. K. Meade & Co., Archts. and Engrs., 11 East Fayette St., Baltimore, Md., is receiving bids for the construction of a 2 story lime plant, here, along tracks of the Norfolk & Western R.R., for the Kimballton Lime Co. Estimated cost, $85,000. W. T. Doosing, Shawsville, Pres.

W. Va., Bluefield—The Bluefield Ice & Cold Storage Co. has awarded the contract for the construction of an ice plant on Bluefield Ave. and Poplar St. Estimated cost, $60,000.

Wis., Clinton Junction—The Bowman Dairy Co., 140 West Ontario St., Chicago, is having plans prepared for the construction of a 1 story, 57 x 200 ft. bottling plant. Estimated cost, $60,000. A Peck, Mgr., F. B. Gray, 844 1st Natl. Bank Bldg., Aurora, Ill., Archt.

Wis., Sheboygan — The Amer. Hide & Leather Co., 1102 Wisconsin Ave., is having preliminary plans prepared for the construction of a steam ash chute and conveyor system. Estimated cost, $25,000. Address E. A. Juul, 805 North 8th St., Engr.

Ont., St. Thomas—The Council is having plans prepared for improvements to the civic gas plant, including erection of new retort house. Estimated cost, $175,000. A. Curtis, Chn. W. N. Miller, City Hall, Engr.